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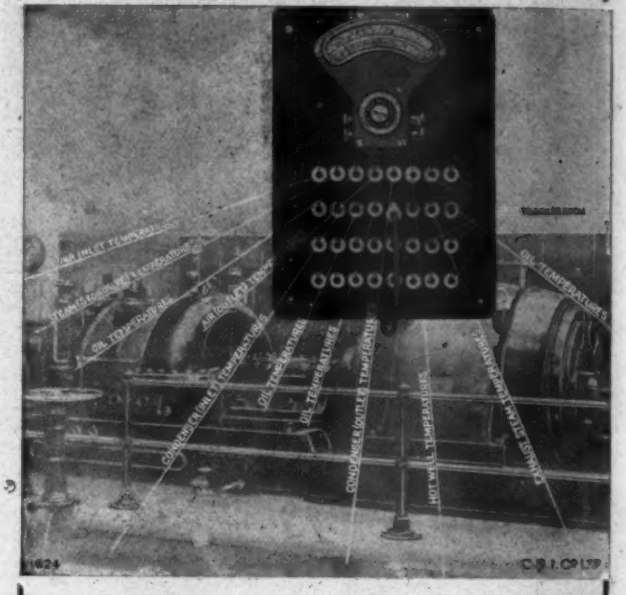

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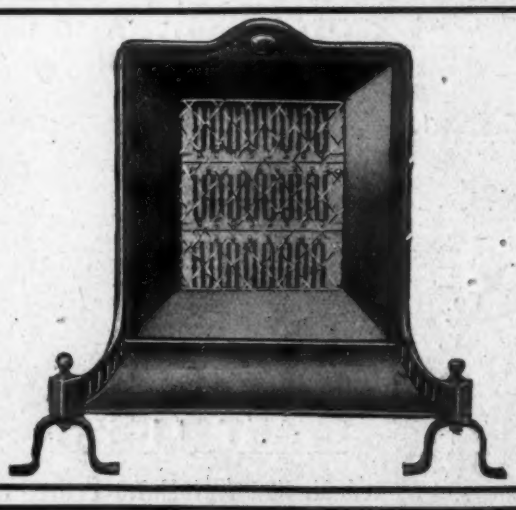

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ELECTRICAL REVIEW.

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ELECTRICAL INTERCONNECTION IN LANCASHIRE AND CHESHIRE.

THE second report of the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems, which we reproduce elsewhere in this issue, will be studied with great interest by electricity suppliers throughout the country. The Committee presented an interim report in September, 1916, which formed the basis of the Manchester Conference in March last; one result of this was a semi-official invitation to the Committee to work out the essential details of a scheme, which are embodied in the report just issued. The important feature of this report, to our mind, is that it presents concrete proposals to the electricity suppliers of the country—instead of the intangible nebulosity which has so far enshrouded official deliberations on the matter.

It would be premature to suggest that the recommendations set forth—though they are made by authorities whose intimate knowledge of the inner working of both municipal and private electricity supply undertakings is beyond question—will result in unalloyed harmony amongst the many authorities with conflicting interests in the area concerned. To achieve such a result at all is an impossibility in an average community; but despite the difficulties which one may discern lurking in the background, there is sufficient in the second report of the Committee to form a working basis for a practical scheme of electricity supply on a scale which accords with modern ideas—one which provides for the evolution of electricity supply along well-recognised lines, with the least possible disturbance to financial and local interests.

The report, which should be studied in detail, is in two sections, the first portion dealing with the constitution and powers of a proposed Joint Board, representative of both local authority and company interests, and its powers—which practically amount to the general control of the operation of the generating stations in the area, the formulation of tariffs for bulk, stand-by, and reciprocal supplies, the allocation of financial charges incurred in giving such supplies, and the making of the necessary agreements between the various authorities. The Board would also act in an advisory capacity, and to facilitate its work it would be divided into four District Boards representing groups of undertakings, and these would elect a central executive, both the boards and the executive having various powers delegated to them. It is not proposed to invest the Board with any powers to raise capital, the present arrangement being regarded as sufficient "under existing conditions" and in view of the proposed allocation of expenditure between participating authorities.

Amongst other matters which we can only briefly mention are compulsory powers for wayleaves, and public road crossings; also powers to reimburse authorities who may

be adversely affected financially through co-ordination. The Committee records its opinion that *no direct profits* should be made on the class of supply dealt with in the report, except under special (and quite obvious) conditions; it further advocates the exemption from local taxation of interconnecting mains and plant, except where used for distribution purposes.

This section of the report deals with matters arising from the interconnection of supply undertakings, but the Committee recognises that this is but a first step, and that at the present rate of increase in the maximum load of the area dealt with, *i.e.*, 32,000 KW. per annum, the question of generating capacity must be considered, although not strictly within the terms of its reference. It therefore recommends in a supplementary section of the report that the Joint Board should have powers to erect new power stations and to acquire existing ones, considering it advantageous that the financial and controlling powers in the area should be centred under one owning and operating authority. In the case of companies it is suggested that this would probably involve purchase of their entire undertakings, though it should be noted that the Committee feels that the rights of statutory undertakings should be maintained as regards the distribution and sale of energy.

The Committee voices its agreement with the recommendation tendered to the Board of Trade Electrical Trades Committee advocating the appointment of a new tribunal consisting of a limited number of Electricity Commissioners, but suggests that the latter should be the central authority on technical matters, besides possessing all other powers now exercised by Government departments, or which may be conferred on them. The portion of the report dealing with the acquisition, &c., of generating stations has not been subscribed to by the three company representatives on the Committee, for obvious reasons; one municipal representative also disagrees with the further powers proposed for the Joint Board.

We have necessarily dealt somewhat cursorily with the report, which demands more leisure than we possess at the moment. To us it represents, on the whole, a carefully studied working scheme, drawn up with a view to furthering the national interests in cheap electricity supply, in the best of all possible ways, *i.e.*, by the mutual co-operation of existing supply authorities under expert guidance.

The L.C.C. Tramways.

The question why the London electric tramway system, providing transportation for a population numbering some 4½ millions, is barely able financially to keep its head above water, whilst the tramways of other great cities with less than a quarter of that population, such as Glasgow, Manchester, and Liverpool, not only cover all their expenses, including large allocations to the redemption of debt and the building-up of large reserves, but also contribute very substantial sums to the reduction of the rates, presents a serious problem for the consideration of the residents in the County Council's area of administration. It is a matter of considerable complexity, and no single cause can be assigned for the disappointing results that are annually made public. It must be admitted that the conditions obtaining in the Metropolis present wide divergences from those existing in any other British city, and consequently it is hardly possible to institute comparisons on an equitable basis; but even if the case of London be considered without regard to what can be done elsewhere, it is difficult to believe that the results so far achieved are the best attainable.

Perhaps the greatest misfortune that the system has suffered has been the fact that from the beginning it was the victim of political manœuvring and the sport of rival parties, not only in the Council, but also in the State. By the adoption of the underground conduit system, the consequences of which policy were foretold in our pages, the undertaking was saddled with a tremendous financial burden from the start; as Mr. A. J. Lawson reminds us elsewhere in this issue, the Glasgow tramway system cost less than half as much per mile as the London tramways, although in later years the trolley system has been adopted for a large proportion of the latter. This initial error can never be wholly retrieved. The tramways also were debited with heavy charges for road widening and other improvements, the benefits of which, however, have enured very largely to other interests. Again, though this circumstance is not restricted to London, the cost of maintaining the paving between and alongside of the tracks is a heavy item, which in fairness ought not to fall upon the tramways alone—particularly in view of the competition set up by motor-'buses, which wear out the roadway more rapidly than any other agency, and yet contribute practically nothing to the cost of their maintenance. Another excessively costly burden is the provision of transportation at rates far below cost price, known as "workman's fares," but in actual fact at the service of all persons travelling between certain hours of the morning. These fares were granted in pre-war days, and were undoubtedly reduced to their present absurdly low level for political purposes; whether the desired end was achieved or not we do not know, but it is certain that the loss on this class of fares is in reality simply a subsidy paid to the London employers, who would otherwise have had to pay higher wages to their workpeople.

Even at that, it is grossly unfair, as Mr. Lawson points out, for only those employés who go to work early in the morning can travel at the cheap rates. The absurdity of the position is well brought out if one contrasts it with the well-known "restricted-hour" tariff in electricity supply. In the former case, the charges are reduced to a nominal value during the morning peak load, and are maintained at a far higher value during the slack hours; in the latter case, those who use the supply during the peak-load hours quite properly have to pay correspondingly higher rates, and it is the users in the slack hours who are encouraged with cheap rates. Surely the present management of the L.C.C. tramways—on the commercial side—is the very antithesis of scientific method; it is also unjust, and, worst of all, unsuccessful. The system is also burdened with excessive capital outlay, and oppressed by unfair competition; the former cannot be remedied, but at least the L.C.C. should secure some control over the competing omnibuses, such as is already vested in provincial municipalities.

It may be argued that the tramways are not intended to make profits, or even to pay their way—that their purpose is to carry the people at the lowest possible rates, the resulting benefits to the county more than outweighing the cost of meeting the deficit. This is quite a comprehensible, if somewhat Socialistic, point of view, and there is much to be said in its favour—but if this be the intention of the Council, it ought to be openly avowed, and avowed beforehand. It is easy, when one has made a loss, to say one never meant to make a profit, but it is not convincing; and we do not recollect any occasion on which such a policy was advocated by the Council.

Now, if ever, is the time to reform the faulty system of assessing fares, when employment is universal and well paid; we do not suggest that extra charges should be made during peak-load hours, but at least the absurd anomalies of the existing system should be removed, and the undertaking placed upon a sound financial basis. We believe that it can be done by relieving the tramways of unfair charges, subjecting competitive users of the roads to a fair measure of taxation, and taking steps to ensure that no passenger shall ever be carried below cost price.

At the same time improvements should be made in the service by equalising the intervals between cars, and instructing the drivers and conductors to look out for intending passengers. It is the rule, rather than the exception, on some routes to see three or four cars pass in a bunch, an interval of five minutes or more elapsing before the next bunch comes along, during which period the omnibuses have things all their own way. Cars cannot be prevented from bunching when approaching busy junctions and crossings, or in dense traffic, but when the road is clear a driver should not be permitted to approach within, say, 300 yards of the preceding car. As for keeping a look-out and trying to pick up all the traffic that can be handled—apparently this is not regarded as good form. At any rate, it is not done. In this respect the L.C.C. staff have much to learn from the motor-'bus conductors.

HALIFAX CORPORATION ELECTRICITY WORKS.

To cope with the rapidly increasing demand for electrical energy in the Halifax area, the Corporation recently installed a new turbo-generator set of 6,000 KW., a description of which is given below.

Originally the system was three-wire D.C., but six years ago it was decided to adopt for power supply a three-phase system at 50 cycles, 6,600 volts, and to install a 1,500-KW.

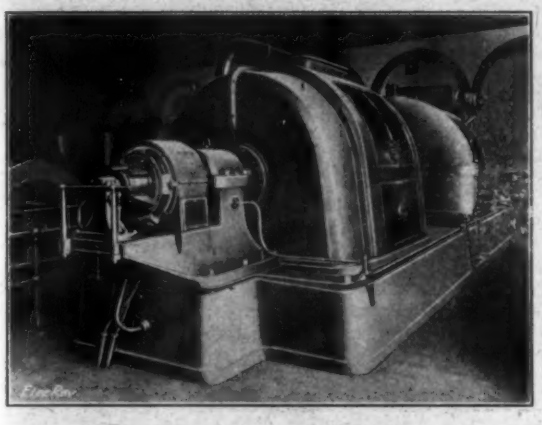


FIG. 1.—B.T.H. 6,000-KW. TURBO-ALTERNATOR AT HALIFAX.

turbo-generator, the British-Thomson Houston Co. being given the contract for this, together with the necessary switchgear, while the Worthington Pump Co. received the contract for the surface condensing plant. At the same time, it was decided to install two 750-KW. rotary converters in order to convert the alternating current to direct current for supplying the ordinary D.C. network for lighting and power purposes, and the overhead lines for traction. The contracts for these rotary converters were also given to the British Thomson-Houston Co. The demand increased very rapidly, and a further turbo-generator with a capacity of 3,500 KW., together with surface condensing plant, was installed at the end of the year 1913, this plant being also divided between the British Thomson-Houston Co. and the Worthington Pump Co., while another 1,000-KW. rotary converter, made by the British Thomson-Houston Co., was installed just as the war commenced in 1914. Owing to the rapid increase in demand for power purposes due to the war, this plant soon became loaded up, and it was therefore decided to install the 6,000-KW. turbo-generator referred to above. This plant was officially started up by Lady Rhondda on July 19th, 1917.

In the meantime the demand has been such that the existing 1,500-KW. and 3,500-KW. turbo-generators have been running practically on full load for over 18 months without any spare, and it speaks well for the reliability of turbo-plant that only one small breakdown occurred during the whole of that time, this being due to a very slight mishap on the governor gear of the small auxiliary turbine driving the condensing plant of the 3,500-KW. set; a repair was effected within three hours of the mishap occurring.

During the time when the above extensions were being made to the generating plant, substantial additions were made to the steam-raising plant in the shape of four Babcock & Wilcox water-tube boilers, two of which were capable of generating 21,000 lb. of steam per hour, one 30,000 lb. per hour, and the remaining boiler 27,000 lb. per hour. The first two are fitted with chain-grate stokers of Messrs. Babcock & Wilcox's make, while the others are fitted with the underfeed type of stoker, as made by the Underfeed Stoker Co., the forced draught for these being provided by fans made by Messrs. Musgrave & Co., of Belfast. At the present time the boiler-house plant is barely sufficient to cope with the demand, but another water-tube boiler, to evaporate 30,000 lb. of steam per hour, is being supplied by Messrs. Babcock & Wilcox, together with Green economisers and an induced-draught fan by Messrs. Musgrave & Co. This plant should have been ready for delivery before the winter load comes on, but it is doubtful whether the delivery date promised will be kept, owing to the difficulty in obtaining steel plates.

The recent progress of the undertaking may be gauged by the fact that whereas the annual output (sold) up to the end of March, 1911, had not exceeded 6 million units, in 1913 it was 7½ millions, in 1915 11 millions, and in 1916-17 16,703,101 units; the maximum demand rose during the period referred to from 2,960 KW. to 6,784 KW. in 1916-17. Since 1899 the revenue account has shown a surplus every year, and the history of the undertaking has been a record of continual upward progress.

By the courtesy of the borough electrical engineer, Mr. W. M. Rogerson, M.I.E.E., who has been responsible for the design and supervision of the whole of the extensions, we are enabled to reproduce photographs of the new plant. The turbine is of the well-known Curtis horizontal impulse type as manufactured by the British Thomson-Houston Co., Ltd., of Rugby, being similar to the 3,500-KW. set which was installed some three and a-half years ago, except that it is of the 11-stage type, running at a speed of 1,500 R.P.M., with a steam pressure of 150 lb. per sq. in. and superheat of 500° F.

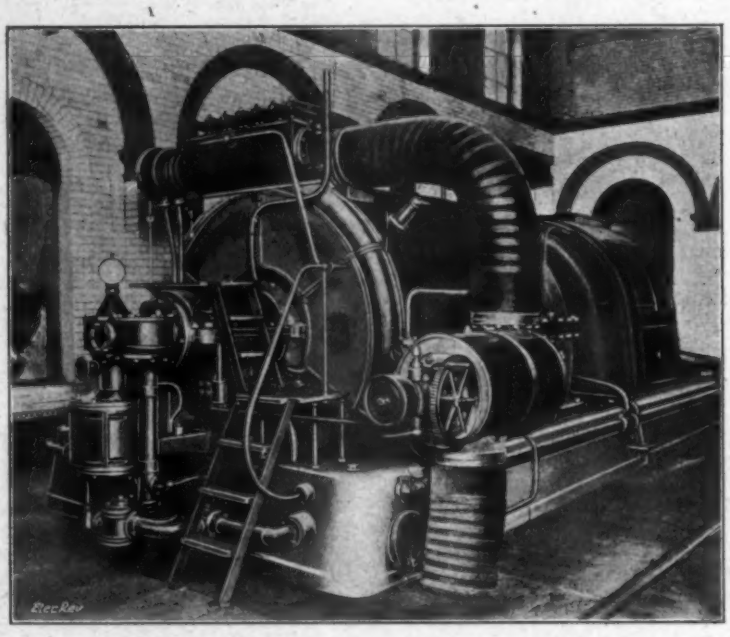


FIG. 2.—B.T.H. TURBO-ALTERNATOR, STEAM END.

The alternator is of the revolving-field type, connected direct by a flexible coupling to the shaft of the turbine. The machine is designed so as to require no external ventilating fans; air is drawn through a special air duct at the bottom of the machine, passing through filters before entering the air duct, and is expelled into the engine room through an opening in the top of the machine.

The exciter is driven direct by means of a flexible coupling from the alternator shaft.

The normal full load of the set is 6,000 KW. at 100 per cent. power factor and 7,500 K.V.A. at 80 per cent. power

factor, and the alternator is capable of 25 per cent. overload output for a period of two hours at 80 per cent. power factor. The voltage is controlled by a Tirrill regulator fixed on the switchboard. The guaranteed steam consumption per KW.-hour at 100 per cent. power factor and with a 28-in. vacuum is as follows:—1¼ full load, 14·0 lb. per KW.-hour; full load, 14·1 lb. per KW.-hour; ¾ full load, 14·4 lb. per KW.-hour; ½ full load, 15·3 lb. per KW.-hour. The above figures are guaranteed with a 2½ per cent. margin.

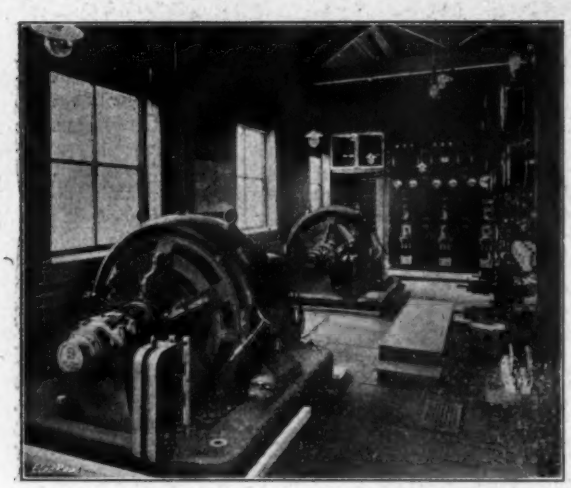


FIG. 3.—WITTON ROTARY CONVERTERS AND SWITCHBOARDS AT HIPPERHOLME SUB-STATION.

The condensing plant was supplied by the Worthington Pump Co., Ltd., and consists of a circular surface condenser with a cooling surface of 16,500 sq. ft. The circulating pump is of the 16-in. twin high-speed type dealing with 12,500 gallons of water per minute against a total head of 42 ft., lifting the water to the top of the existing cooling towers.

The air pump is of a somewhat novel type, consisting of a 10-in. rotary air pump and an 8-in. low-lift operating pump. These pumps take water from a tank and discharge it through a regulating valve into the nozzle of an ejector. When leaving the nozzle the water passes through a wheel, by which the jet is divided up into a number of jets of approximately rectangular cross section, leaving sufficient space between each other for the entry of air and vapours removed from the condenser; at the same time, the wheel imparts to the jets a rapidly revolving motion, as a result of which the water jets rush through the ejector cone and diffuser in the form of a helix with a pitch and velocity diminishing as the compression of air and vapours proceeds.

The air and vapours from the condenser entering round the rotary transforming wheel are caught and enclosed by the issuing water jets, and compressed on the way down to the diffuser discharge. The water discharged by the ejector into the tank gives up the air entrained, and is circulated over again by the centrifugal pump, and in order to prevent an undesirable rise in temperature in the operating water by the process, cold water is constantly supplied to the tank. The results of this apparatus have been highly satisfactory; it is extremely simple, and can run practically without attention. The vacuum obtained is excellent, and the power required moderate. It has the advantage that if air leaks open up in the system, causing the vacuum to drop, it will accommodate itself to such condition, and maintain the best possible vacuum, and if the cause of the leak is removed, will pull the vacuum to the original height.

If the transforming wheel stopped or was taken out altogether the efficiency and vacuum would be reduced, but the machine would continue its work just the same.

For extracting the condensed steam from the condenser and delivering it into the hot well on the engine-room floor level, a 5-in. two-stage centrifugal hot-well pump is provided.

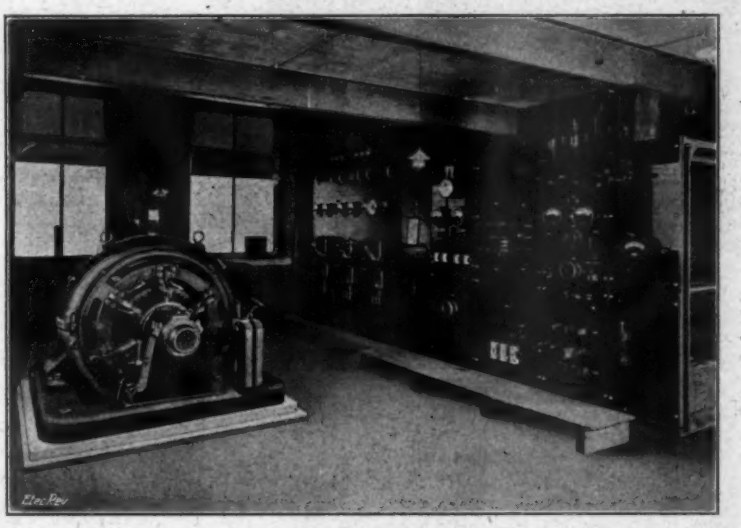


FIG. 5.—HEBDEN BRIDGE SUB-STATION.

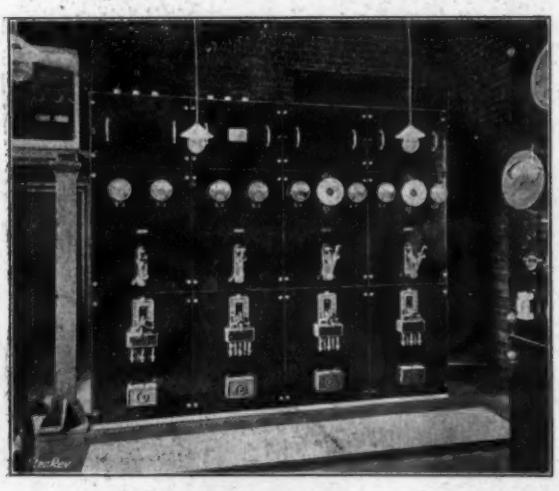


FIG. 4.—WITTON MISTAKE-PROOF IRONCLAD SWITCHBOARD AT HIPPERHOLME.

All the above pumps are arranged on one convenient bedplate, and are driven by a horizontal single-stage Curtis turbine, rated at 275 B.H.P., the exhaust steam from which is taken direct to the condenser.

The cost of the whole plant, including foundations, piping, &c., has been approximately £23,000.

It is interesting to note that the above set has displaced a 300-KW. Pollit engine and alternator and two 200-KW. Parsons D.C. turbo-generators, which plant was installed some 18 years ago.

In order to afford a supply of continuous current to the outlying areas of Hebden Bridge and Hipperholme, the Halifax Corporation has recently constructed two converting stations in these districts. For the electrical equipments of these sub-stations the contract was entrusted to the General Electric Co., Ltd., of London. The converting unit chosen was the 250-KW. Witton rotary converter, together with an oil-insulated air-cooled transformer, taking in three-phase power at 6,600 volts, and generating at 550 volts for traction and 220-0-220 volts for lighting, the rotary converters serving the double purpose.

The incoming feeders are controlled in each sub-station by Witton mistake-proof switchboards. The Hipper-

holme sub-station, having two converting units, has two incoming feeder panels on the high-tension board, and two machine panels; that at Hebden Bridge has but one machine panel. These installations are carried out on the Witton boiler-plate cubicle system for sub-stations. The cubicles eliminate the possibility of accident to the operator through inadvertence, a throrough interlocking arrangement preventing such occurrences.

The rotary converters run at a speed of 1,000 R.P.M., and are designed for reactance control. For the purpose of keeping constant the voltage across the three-wire network, the neutral wire is taken from the star-point of the transformers. The converters are of the self-synchronising pattern, being run up to speed by a starting motor and switched in through choking coils. They fall into step easily without any synchronising and without any reversal of polarity.

The Witton low-tension boards include both traction and lighting panels, and a simple arrangement of interlocks between the liquid starter for the motor, the circuit breaker, and the short-circuiting switch for the liquid starter, precludes any possibility of errror in the sequence of the operations. Change-over switches are also included on the board for applying the machines either to lighting or traction, and these switches make provision for the opening of the neutral connection when the machines are required for the latter purpose.

We are indebted to Mr. W. M. Rogerson, borough electrical engineer of Halifax, for assistance in preparing this description.

LONDON COUNTY COUNCIL TRAMWAY RESULTS IN 1916-17.

By A. J. LAWSON, M.Inst.C.E.

The accounts for the past year's working of the tramways of the London County Council were presented in final adjusted form at the Council meeting held on July 17th, and the following tabulated synopsis and analysis gives the chief items of information :—

Total receipts for year	£2,552,204
Receipts from passenger fares	£2,476,309
Operating expenses	£1,817,694
Interest on borrowed money	£314,165
Redemption of debt	£429,851
Total expenses	£2,561,710
or £9,506 more than the total receipts.	
Route miles operated	141·67
Revenue per route-mile	£17,479
Car-miles run	49,478,973
Passengers carried	586,127,976
Passengers per car-mile	11·846
Average fare per passenger	1·014d.
Operating expenses per passenger ...	·744d.
Total expenses per passenger	1·049d.
(including interest on and repayment of debt)	
Operating expenses per car-mile ...	8·817d.
Total expenses per car-mile	**12·424d.**
Total receipts per car-mile	**12·420d.**
Receipts per car-mile from passengers' fares	**12·011d.**

Actually, therefore, the total revenue properly appertaining to the working of the tramways was £9,506 short of the total revenue required to meet all expenses, but owing chiefly to interest received on cash balances, and interest or rent from surplus properties, there is shown a credit balance or surplus of £11,342 10s. 3d., which is carried to the renewals fund account, being the first addition thereto since 1912-13—and more in name than in reality, since no account is taken of the depreciation in investments which that fund represents, nor of the depreciation of investments in which the general reserve fund is supposed to be placed.

The nominal value of these at March 31st last was :—

Renewals fund	£282,978
General reserve fund	72,391

The total debt incurred up to March 31st, 1917, was £13,930,660, of which £4,788,834 had been repaid, leaving the amount outstanding £9,141,826.

Owing to the electrification of the horse tramways, capital expenditure of £2,024,689 has become obsolete, of which, after taking all credits into account, £943,741 has still to be provided for, besides a further amount of not less than £117,826, representing *expenditure incurred in connection with electric traction which has also been rendered obsolete, while much more is obsolescent.*

The outlook is far from hopeful. Increased payments to drivers and conductors, and heavy salaries for newly-created officers, make large holes in any increase in revenue from passengers; yet the Council continues to make bird pecks—they can't even be called bites—at the passenger-fare cherry.

True, it has "suspended" halfpenny fares and return tickets, with the prospect of reaping a benefit of about £315,000 a year, or about £1,000 per work-day, from these sources; but it studiously refrains from touching the workmen's fares, though the people who benefit by them are by no means the poorest or worst paid of the wage earners who travel by the Council's tramcars. It has been often remarked by workmen themselves that those who can afford to live some distance from the centre of London, and who, therefore, can get houses at cheap rents and low rates, get also the cheapest tramway fares, and this is borne out by the reports of the Highways Committee, which show that a workman living in the neighbourhood of the Tower Bridge (where neither rents nor rates are low), who travels daily to Waterloo Station, a distance of 2 miles only, has to pay 1d. for a single or 2d. for a return ticket—just the same as the probably better-off artisan who dwells in a suburban "villa" in the Beckenham or Bromley district, but is employed in the neighbourhood of Victoria Station, who can ride 9½ miles each way for the same money. *The average length of the workmen's routes is over 5 miles for a penny fare.* The poor clerk, or underpaid shop girl or waitress, whose hours are from 8.30 or 9 a.m. to any time at night, does not benefit at all from cheap tramway fares. He or she has to pay three times as much as the better-paid workman for the same distance, or get up to town an hour before office or shop is opened for business, and waste that time in aimless wandering about the streets in all sorts of weather, tiring himself or herself out, or getting drenched with rain, and laying the foundations for future illness, before the day's work is begun.

The Council has at last decided that the issue of transfer tickets shall be limited to places to or from which there are no direct services, and that such tickets shall be available for change of cars at specified points only. It is to be hoped that these tickets will in all cases be cancelled on the second car; cases have been known of 3d. transfer tickets issued in the morning at Woolwich being used on the Tooting and Merton lines late at night on the same day; and, in some cases, of transfer tickets, issued three weeks previously, still remaining uncancelled, though the holder rode on the cars daily without being called upon for another fare. Inspection appears to be woefully deficient. The chairman of the Highways Committee stated :—"The tramways have been of late systematically defrauded, not only by a section of the public, but by members of our own staff. People crowding off the cars have handed the fare to the conductors, but no tickets have been given. In some cases there has been no attempt to collect fares, but a hat has been handed round for the benefit of the 'driver and conductor.'" He also stated that "the loss from non-collection of fares and fraud had been estimated at from 5 to 15 per cent. of the takings." Though these figures represent from £125,000 to £375,000 a year, the one-time correctly named Progressive party has recently, on each occasion that reform was proposed, carried its opposition to the means of preventing these frauds to the extent of dividing the Council in several party divisions.

The expression "wrecking the tramways" has taken a new meaning, and the thanks of the general public—all tramway passengers included—will be given to Mr. G. H. Hume if, during his chairmanship of the Highways Committee, he will still more courageously root up the abuses which have nearly destroyed the tramway enterprise, and stop the dry rot that has developed in the system.

It should be recognised that under present conditions of

travel on the tramways, with the maximum possible loading of cars twice a day—two hours in the morning and two hours in the evening, which are the real business traffic hours—the maximum carrying capacity of the present County Council routes cannot much, if at all, exceed 600,000,000 passengers a year, and that to safely provide for all costs and charges, the average fare per passenger must be 1·16d. at least, which would represent with rather over 12 passengers per car-mile an average of 14d. per car-mile in revenue.

The irregularity of the services on some lines, as on the Tooting and Merton and Norbury routes, for instance, should be remedied. On these lines it is not unusual to see two or more cars for the same destination following each other in quick succession, with long intervals between the next following ones, the result of which is the filling of motor-'buses to overcrowding, and consequent loss to the tramways. A nominal six minutes' service should not produce ten-minute intervals without a "Selection by the Band."

Fares on the L.C.C. tramways bear no relation to distance or cost of operating. From Abbey Wood, Kent, to Waterloo Bridge, on the Victoria Embankment, either by way of Blackfriars, New Kent Road, New Cross and Woolwich, or by Westminster Bridge, Kennington, Camberwell, New Cross and Woolwich—a distance of over 14 miles—the ordinary fare is 3d. only (or less than a farthing per mile); while, as has been seen, a person taking a workman's ticket can travel 19 miles for 2d.

In Glasgow, where the tramways cost less than 42 per cent. of the cost of construction and equipment of the London lines, the fare is about ½d. per mile, or twice what it is in London. Glasgow has also repaid the total capital expenditure on its tramways.

If the London County Council were to make all fares 1d. for any distance up to 2 miles, with ½d. additions for every additional mile or part of a mile, and give workmen return tickets for single fares, the tramways would be at once placed on a paying basis without injustice to anybody.

SOME NOTES ON STAFF ORGANISATION IN ELECTRICITY WORKS.

By G. W. STUBBINGS.

The present article is intended as a contribution to the discussion on the organisation of the staffs of electricity undertakings, and is written with a view to inquiring whether a particular system, the adoption of which is becoming more general, is capable of improvement. The system in question can be briefly defined as one in which the staff consists of a chief engineer with four departmental assistants concerned respectively with the secretarial, commercial, generating, and distributing section of the undertaking, each being directly responsible to the chief engineer. The writer's remarks are intended to apply to stations of moderate size, having an output of the order of 10,000,000 units per annum.

It will be interesting first to trace the development of the organisation of the staffs of electricity works, and to see how the particular system referred to was evolved. In the early days of electricity supply, when the technical skill required to run a works was considerable, and the business was fairly small, the chief was mainly concerned with technical matters, and was, in fact, the man who ran the job. With the development of the undertaking it became necessary for the chief engineer to have an assistant, such assistant being an all-round man, competent, in the absence of the chief, to supervise all branches of the work, and *au fait* with all the details of the plant. As the scope of the undertaking became further extended, it became clear that the multiplication of general assistants was impracticable. In the first place, as more and more purely managerial work devolved upon the chief, he was able to devote less and less time to technical work; and, secondly, the money available for salaries necessitated the limiting of the number of general assistants to one, the chief assistant engineer. More recently, the system of having departmental assistants, directly responsible to the chief, has been evolved. The remarkable characteristic of this system is, of course, the abolition of the chief assistant. This radical departure from previous practice has worked very much better than would be expected. It possesses the great advantage of cheapness, as the saving to the undertaking, even after duly increasing the salaries of the departmental officials in recognition of their extra responsibility, is considerable. The advocates of this system consider that the cost of retaining the services of an official additional to the chief engineer, capable of, and possessing the necessary qualifications for, controlling all departments of the undertaking, would be prohibitive, at any rate, for stations of moderate size, and that unquestionably money is better expended in increasing the salaries of the departmental assistants. On the other hand, with this system, there is no one, in the absence of the chief, to assume complete responsibility, as it obviously creates difficulties to assign such a post to either the works or the distribution engineers if these officials be of approximately equal status. The chief assistant seems, moreover, the right man to undertake such work as the designing and preparation of schemes for not only extensions, but also for the various minor alterations and improvements that are continually taking place in an up-to-date works.

The functions of the four departmental assistants may be briefly considered. The secretary or chief clerk takes charge of work quite separate from engineering, and such work falls naturally into a division by itself. The status usually assigned to this official need not, therefore, be discussed.

The case for the commercial assistant or publicity manager is not, perhaps, so clear. There has been a great tendency lately to magnify the importance of this official, but in a moderate undertaking the wisdom of such a course seems to be questionable. The smaller part of publicity work, that of canvassing new consumers, or introducing small heating and cooking apparatus or small motors, does not call for a very highly-trained or highly-paid official. Regarding the supply of electricity to large power consumers, there is no doubt that the personality and business experience of the representative of the undertaking will be an important factor contributing to success, and it seems quite clear that in moderate sized undertakings no better person can be found for this task than the chief. His status, address, technical skill and business ability will carry greater weight than that of a junior official, and as such negotiations are comparatively rare, the undertaking could not afford to retain the services of an official possessing qualifications for such work comparable with those of the chief. It seems clear, therefore, that the publicity manager need not be a man of very great importance, and, indeed, the suggestion of amalgamating the clerical and commercial departments is worthy of consideration for the smaller undertakings. A larger salary could be paid to the secretary, who would in such case be a man of commercial as well as secretarial experience.

In a system of staff organisation recently described in this journal, the official in charge of the publicity department was designated consumers' engineer, and was responsible for not only commercial work, but also for the test-room, installation and public lighting departments. It seems difficult to justify the amalgamation of four sections so totally dissimilar; the first commercial, the second scientific, and the last two concerned with maintenance work. The only sort of explanation that can be found for such a combination is that the work with which these sections are concerned is external to the works and above ground, as in no other characteristic do they agree. With a department of so heterogeneous a character, the official in charge can hardly be expected to be *au fait* with all phases of the work; and as his abilities will presumably be of a commercial character, the men really responsible for the other sections suffer in status. If, on the other hand, the consumers' engineer is chosen for his ability to supervise testing, installation, or public lighting maintenance work, there is no guarantee of his commercial ability, and the suggestion to amalgamate this section with the clerical department seems the more reasonable. The

writer is not aware whether this arrangement is a usual one, but, considered from a rational standpoint, it appears, owing to the varied nature of the work concerned, to be as defective a scheme as could be devised.

The works department is another which is divided naturally from the others, and the duties and scope of the responsibilities of the works superintendent are well defined. It is becoming more and more realised in these days that the greatest need for supervision is in the boiler house, and it therefore seems advisable that in moderate undertakings the works engineer be chosen more for his boiler house than his engine room experience.

The fourth department to be considered is usually known as the distribution department, and the responsibilities of the official in charge are frequently very varied, comprising as they usually do everything left over from other departments. In various concerns, mains, public lighting, testing, installation, tramway overhead equipment, and occasionally fire alarms are under the control of the distribution engineer. Obviously, it is expecting a good deal to require a moderately-paid official to have had experience in all these branches. His first requirement is naturally to be a skilful mains engineer, and presumably the greater part of his experience will be concerned with mains work. Some of the other sections, such as wiring or tramways overhead equipment work, have a natural and close connection with mains work; but in the case of testing of instruments and meters, the connection is not so obvious. The arrangement is, however, common, and in practice works very well.

The assistants of these four officials will be similar in experience and general qualifications to their departmental chiefs, and such men will have in view either promotion to the post of their immediate superior, or a similar position elsewhere.

An examination of the scope of the control of, and the qualifications requisite for, each of the four officials considered, draws attention to the fact that in none of them is there any great need or desirability of any particular scientific technical ability. The station and distribution superintendents are the only two officials who can really be called engineers, and with both, the side of engineering with which they are most concerned is applied, as opposed to scientific. As before remarked, the assistants of these officials will approximate to them in technical character, and thus it happens that in many central stations there is no one with any particular scientific ability, and, according to the usual arrangement, there is no one who need have such a qualification. In running a central station, scientific questions are continually cropping up, but owing to the engineering officials having applied themselves largely to other matters, the scientific knowledge that they acquired early in their career, if any, has probably got rusty or obsolete. This is regrettable, as often leading to mistakes which, though of small importance, could be avoided, and frequently necessitating reference to manufacturing firms for technical advice. There is no particular harm in this latter circumstance, but it is not as it should be. The question therefore arises as to the advisability of having a further official, whose chief qualification shall be scientific and technical ability, directly responsible to the chief engineer, and who will take charge of all work of a technical or scientific character. Such an official, who might be designated technical assistant, would primarily be responsible for the testing and maintenance of all meters and instruments, and would carry out other testing work such as that of fuel and water; he should also be a good draughtsman, competent to carry out such drawing work as is required in a station of the size under consideration. Such an official may be considered a kind of glorified meter superintendent, but the great difference between this official and the meter superintendent is not only in status, but in salary. If it be assumed that by restricting the scope of the responsibilities of the mains engineer, and by abolishing the commercial assistant, as suggested, a considerable sum of money is liberated for the salary of the new official, the undertaking would be able to obtain a really first-class man. Such a post would enable the chief engineer to rely upon at least one man of his staff to keep his scientific knowledge up to date, and such a man, having the requisite status, could be, and probably would be, consulted on subjects coming within the scope of his particular knowledge.

It has long been a matter of observation to the present writer that, under present conditions, there is little prospect of advancement in central station work for men whose abilities are rather scientific than inclining to running or maintenance work. Many a young man has started a central station career with a brilliant scholastic record—not necessarily of the academic order, but quite conforming to the ideals of Prof. Perry. Such men, seeing how little their qualifications are valued in the career they have chosen will frequently allow their knowledge to become rusty, and will endeavour to make themselves capable shift engineers or mains superintendents, quick and decisive in times of breakdown. Possessing qualifications in one direction, it is exceedingly unlikely that they will exhibit them in another, and such men become mediocre and nonentities. If it be recognised that there is no place in a central station for men such as have been described, these would simply be instances of their having chosen unsuitable careers; but this can hardly be the case. With three-phase distribution, even an ordinary meter superintendent should have a moderate scientific knowledge thoroughly to understand his work. There is little doubt that if a definite place were found for them, men would be attracted to central station work who would be found invaluable. The engineers in charge of large test rooms are, of course, important officials, but such posts are rare. The writer's remarks refer to stations of moderate output.

In considering the question forming the subject of this article, the writer has endeavoured to take up a more or less detached standpoint—such as that of a shrewd business man, knowing nothing of electricity, who has had central station routine throughly explained to him. The suggestions may not be considered altogether practicable, but the writer hopes that, as they are somewhat original, they may be found a little interesting.

SECOND REPORT OF THE COMMITTEE FOR THE INTERCONNECTION OF THE LANCASHIRE AND CHESHIRE ELECTRICITY SUPPLY SYSTEMS.

We have received from the hon. secretary a copy of a report just issued by the Committee which has been dealing with the interconnection of the Lancashire and Cheshire electricity undertakings. The first report was published in our issue of October 13th, 1916; the report now issued gives practical shape to the matters discussed in the earlier one, and so far as the first portion, dealing with interlinking, is concerned, is signed by—

Mr. S. L. Pearce, *Chairman.*
Mr. B. Welbourn, *Vice-Chairman.*
Mr. J. A. Robertson, *Hon. Secretary.*

Sir John A. F. Aspinall, Messrs. R. Blackmore, S. E. Britton, H. Dickinson, E. H. Edwardes, John Purrett, S. J. Watson, P. P. Wheelwright, and W. J. H. Wood, *Members of Committee.*

Introduction.—1. The interim report presented by the Committee in September, 1916, to the supply authorities and the Board of Trade formed the basis of the conference held in the Council Chamber of the Town Hall, Manchester, on March 2nd, 1917, which was presided over by Mr. G. H. Roberts, M.P., Parliamentary Secretary to the Board of Trade.

2. The conference revealed a striking degree of unanimity with the principles set out in the interim report, and as a result of the invitation extended by Mr. Roberts to the conference, the Committee have worked out the essential details of the scheme which are embodied in this report.

3. The Committee now have pleasure in submitting their second report, which may conveniently be divided under the following headings:—

(*a*) The constitution of the proposed joint board.
(*b*) The powers of the proposed joint board.
(*c*) The basis for determining the charges for electricity supplies between participating authorities.

(*d*) The basis for allocating the capital charges on interconnecting mains and transformers against the revenue accounts of the participating authorities.

(*e*) Miscellaneous provisions.

The Committee have also come to the conclusion that the interconnection of the several supply undertakings is but the first step to be taken in the reorganisation of the existing interests with a view to securing an adequate, cheap, and reliable supply of electrical energy for industrial and all other purposes.

They have therefore added a further section to the present report, setting forth their considered opinion in regard to:—

(*f*) The conferment of additional powers upon the joint board in regard to the establishment and control of all future power stations, and the further control of existing power stations where deemed desirable in the national interests.

(*g*) The relation of the joint board to the existing Government departments, or to any new electricity tribunal that may hereafter be set up.

Constitution of Proposed Joint Board.—4. The Committee propose (with the assistance of fresh legislation) the establishment of a joint board, representative of the local authority and company interests.

Every authorised distributor of electrical energy shall be entitled to representation on the joint board.

The basis of local authority representation shall be the "population" of the area supplied under statutory powers, viz.:—

One representative for a local authority with a population not exceeding 25,000.

Two representatives for a local authority with a population in excess of 25,000 but not exceeding 50,000.

Three representatives for a local authority with a population in excess of 50,000 but not exceeding 100,000.

Four representatives for a local authority with a population in excess of 100,000 but not exceeding 200,000.

Five representatives for a local authority with a population in excess of 200,000 but not exceeding 350,000.

Six representatives for a local authority with a population in excess of 350,000, but not exceeding 500,000.

Seven representatives for a local authority with a population in excess of 500,000 but not exceeding 700,000.

Eight representatives for a local authority with a population exceeding 700,000.

The basis of company representation shall be "capital outlay," in comparison with the other undertakings.

A schedule sets forth a list of the "authorised distributors" included in the groups of the interim report; the joint board if constituted at the present time would comprise 35 undertakings, with a membership of 90, but any undertaking hereafter eligible shall be entitled to representation.

In the event of one or more of the companies being excluded for any reason from the joint board, it shall be competent for the joint board to enter into working agreements with such companies.

A revision of the representation of the joint board shall be made every five years.

5. Recognising the disadvantages that would accrue from too large an administrative body, the Committee propose that the joint board shall be divided into district boards, whose members shall be those representing the undertakings corresponding to the groups.

Each district board shall elect a chairman from amongst its own members.

The engineer of each undertaking shall be entitled to attend the meetings of the respective district boards.

6. A central executive of 20 members shall be elected from the district boards.

Each member shall be elected for a period of three years, but shall not remain a member of the central executive if he ceases to be a member of the participating authority by whom he was elected.

The central executive shall elect a chairman from amongst its own members.

Powers of the Proposed Joint Board.—7: The Committee propose that the 35 authorities (local authority and company) at present exercising statutory powers shall be constituted by Act of Parliament as a joint board for the purpose of jointly exercising each and all of the following general powers:—

(*a*) To co-ordinate and prescribe the running hours of the existing generating stations in such a way as to yield the most economical operating conditions.

(*b*) To determine the basis of charges to be made between the various authorities constituting the joint board for:—Bulk supply, stand-by supplies, reciprocal supplies.

(*c*) To allocate all charges against revenue account arising out of the expenditure of moneys on linking-up mains, transformers, and such other works as may be required for interconnecting purposes.

(*d*) To allocate the administrative expenses of the joint board between the various participating authorities, such allocation being based on their respective incomes.

(*e*) To act in an advisory capacity in regard to all proposals for future extensions of generating plant and linking-up mains, transformers, and such other works as may be required for interconnecting purposes that may be put forward from time to time by one or other of the several authorities direct to the proper Government tribunal.

(*f*) To empower the joint board to make working arrangements between the power companies and the local authorities, and between one local authority and another, for the use of the existing mains, and with reference to the laying of new linking-up mains within the areas of the several undertakings participating in the joint scheme of operation, and in such other areas as it may be found necessary to lay linking-up mains.

(*g*) To appoint such officials as may be necessary to carry out the powers and instructions of the joint board.

(*h*) To form district boards representative of the undertakings included under the groups, or such modifications thereof or additions thereto as may hereafter be considered necessary, and to delegate to the district boards the powers set forth below, and such other matters as the joint board may from time to time decide.

(*i*) To form a central executive of the joint board elected from the several district boards, and to invest such central executive with the powers set forth below, and to deal with such other matters as the joint board may from time to time decide.

(*j*) To invest the authorities constituting the joint board with compulsory powers to obtain wayleaves for electric mains, and overhead lines.

(*k*) To invest the authorities constituting the joint board with compulsory powers to lay mains in undedicated streets.

(*l*) To invest the authorities constituting the joint board with compulsory powers to erect overhead lines crossing public roads.

(*m*) To invest the joint board with powers to make regulations in regard to all technical matters affecting linking-up mains, transformers, and such other works as may be required for interconnecting purposes in order to secure uniformity and reliability of supply.

(*n*) To carry out such further powers as may be delegated to them from time to time by the proper Government tribunal.

(*o*) To apply to Parliament for any alteration or extension of their powers, including the granting of new powers.

(*p*) To issue precepts to the participating undertakings for the purpose of meeting the administration expenses of the board.

(*q*) To apportion the costs, charges, and expenses—Parliamentary or otherwise—preliminary and incidental to the setting up of the joint board, on the basis of the capital outlays of the participating undertakings.

8. In the event of it being shown to the satisfaction of the joint board that any undertaking has been adversely affected financially by the operation of the above powers, it shall be incumbent upon the joint board to allocate the charges between the participating authorities so as to reimburse the undertaking so affected.

9. The authorities constituting the joint board shall be empowered to enter into agreements with any authority, company, or person for the following purposes: Bulk supplies, stand-by supplies, reciprocal supplies, provided that no such powers shall be exercised within the area of an authority exercising statutory powers except with the consent of such authority. In the event of the consent being unreasonably withheld, an appeal may be made to the proper Government tribunal to dispense with such consent.

10. The Committee propose that the joint board shall delegate the following powers to the district boards:—

(*a*) To appoint their representatives to act on the central executive of the joint board.

(*b*) To co-ordinate and prescribe, subject to the approval of the central executive of the joint board, the running hours of the existing generating stations within their group in such a way as to yield the most economical operating conditions.

(*c*) To determine, subject to the approval of the central executive of the joint board, the charges to be made between the various undertakings within their group for: Bulk supplies, stand-by supplies, reciprocal supplies.

(*d*) To make recommendations from time to time to the central executive of the joint board with regard to the interconnecting of two or more of the existing undertakings within their group, or with one or more undertakings of another group.

(*e*) To allocate, subject to the approval of the central executive of the joint board, the charges against revenue account arising out of the expenditure of moneys on linking-up mains, transformers, and such other works as may be required for interconnecting purposes between the various participating authorities within their group.

(*f*) To receive and consider the recommendations of any undertaking in the matter of extensions to their generating plant, and to report thereon to the central executive of the joint board, provided that nothing herein is intended to prevent any authority, after its application has been adjudicated upon, from applying direct to the proper Government tribunal under its existing or future rights for powers to borrow money, or to otherwise raise capital for generating plant extensions.

(*g*) To carry out such further powers as may be delegated to them from time to time by the joint board.

Note.—It shall not be competent for the district boards to incur any administrative expenditure without the direct sanction of the joint board.

11. The Committee propose that the joint board shall delegate the following powers to a central executive elected from the several district boards:—

(*a*) To draw up such rules and regulations as may be necessary from time to time for the guidance of the several district boards in giving effect to the various powers delegated to them.

(*b*) To control the co-ordinated and prescribed running hours of the several groups of undertakings respectively controlled by their district boards.

(*c*) To formulate the basis of the charges to be made between the various undertakings in the respective groups, and between one group and another, in regard to bulk supplies, stand-by supplies, reciprocal supplies.

(*d*) To consider the recommendations made to them from time to time by the several district boards in regard to the provision of interconnecting mains, transformers, and such other works as may be required for interconnecting purposes, and, if approved, to support the necessary application on their behalf to the proper Government tribunal.

(*e*) To receive, approve, or otherwise, the reports of the district boards from time to time respecting all proposed applications for extensions to generating plants, provided that nothing herein is intended to prevent any authority, after its application has been adjudicated upon, from applying direct to the proper Government tribunal under its existing or future rights for powers to borrow money, or to otherwise raise capital for generating plant extensions.

(*f*) To sanction, or revise, the proposed allocation of all charges against revenue account arising out of the expenditure on linking-up mains, transformers, and such other works as may be required for interconnecting purposes made by the several district boards.

(*g*) To apportion the administrative expenses of the joint board between the various participating authorities, and to refer same to the joint board for confirmation—the basis of such apportionment to be the gross revenue of the participating undertakings.

(*h*) To report to the Government department or tribunal on any application made to them by any single authority who are at present exercising statutory powers, or who may hereafter apply for such statutory powers, to raise money for generating plant extensions.

(*i*) To recommend to the joint board the appointment, from time to time, of such officials as may be necessary to carry out the powers and instructions of the joint board.

(*j*) To appoint a committee of engineers to whom all technical and engineering matters shall be at first referred for a report, provided that the said committee of engineers shall be entitled to seats on the central executive committee, but shall have no voting powers thereon.

(*k*) To carry out such further powers as may be delegated to them from time to time by the joint board.

12. Should any dispute or difference arise between any undertaking and the district board, or between a district board and the joint board, the same shall be referred to the proper Government tribunal for a decision—which shall be final and binding on the parties concerned.

13. Under the foregoing paragraphs it will be observed that the Committee do not propose to invest the joint board with any financial powers to raise capital from time to time. In this respect, their present proposals differ from those set forth in the interim report, which contemplated the raising of capital for purely interconnecting works, *e.g.*, linking-up mains and transformers, &c.

On further consideration the Committee have come to the conclusion that *under existing conditions* there are no material advantages to be gained in relieving each undertaking of its statutory obligation to raise the necessary capital for interconnecting mains extensions within its own area, provided always the scheme is initiated or approved by the joint board, the important point being the correct allocation of this expenditure between participating authorities.

14. The Committee further recognise that the position of the companies under the proposals contained in this report will require special consideration by reason of the fact that their electrical output is now given under one or other of the following headings:—

(*a*) Bulk supplies to authorised distributors.

(*b*) Bulk supplies to authorised distributors, and individual supplies to large power users in the area of the latter.

(*c*) Supplies given in districts, the provisional orders relating to which have been transferred to the companies for stated periods.

(*d*) Districts in which the companies have taken out and now hold the provisional orders

(*e*) Districts in which no provisional order had been taken out prior to January 1st, 1908, and which the Lancashire Power Co. are supplying by virture of their Acts.

(*To be continued.*)

Australian Bureau of Science.—A meeting of the Advisory Council of the Commonwealth Bureau of Science and Industry was held in Melbourne last month, with the object of establishing the bureau on a permanent basis. It is proposed to appoint permanent directors. The Prime Minister (Mr. Hughes) stated that the bureau had already done much good work. It was engaged at present on a number of scientific problems in connection with the metal industry.—*Melbourne Age.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Employment of Disabled Soldiers.

The letters from "E. M. F." and Alfred Bridges in the current number of the REVIEW prompt me to write this, my first letter to any paper.

I agree with you that it is an insult to offer employment to a man disabled through the war in the worst paid profession in the country. The company advertising no doubt feel that since a discharged man will possibly receive a pension, he may be able to live on his income, and as regards intelligence of officers, the number that apply for a position in a power station must be the means of gauging it.

It is claimed that the station man gets less pay than a man in another trade calling for less skill. For this condition the station man is to blame, since he lacks organisation; and at this moment, when the opportunity is put forward in the Station Engineers' Branch of the E.T.U., the difficulty of getting many men to see the advantages is a point which does not show the station man in a favourable light if a comparison of intelligence is made.

Every profession has its association, which grants certificates of efficiency to its members, thus keeping those undesirables out, who might through influence enter into competition with them for their job.

A switchboard job, while things run smoothly, can be done as a matter of routine by any one of normal intelligence, and it is upon this theory that rates of pay are fixed.

It is hardly likely that any undertaking, private or municipal, would put any difficulty in the way of such an organisation as the S.E. branch, since it would assure a proper degree of efficiency, and a desire to study and become the possessor of a licence or certificate among the staff. When one sees advertisements in the REVIEW for shift engineers at 35s. per week and ticket inspectors on the street railways at £3, one cannot help but see the excuse for the public thinking the position of the engineer is a soft one, calling for no special skill at all.

If the claim of a high standard of intelligence among power station men be true, there will not be one outside the Station Engineers' Branch of the E.T.U. in another two weeks; then, and not before, they may expect to get white men's hours and pay.

I can quite understand the attitude of the switchman and shift engineer towards an ordinary union, but in the revived association mentioned they will find a remedy for their ills. I advise all interested to find out the time and place of the next meeting and go.

Megger.

[With regard to the pension question, which is likely to assume some prominence during the next few years, we desire to enter a strong protest against the policy referred to by our correspondent as a possible explanation of the advertisement under discussion. Any employer who pays a man at a lower rate than his services are worth because he has a pension *is putting a corresponding part of that man's pension into his own pocket*, defrauding the State and the pensioner. We do not accuse any one of having done this; but we fear that cases of the kind may be met with, and we trust that our readers will unhesitatingly show them up.—EDS. ELEC. REV.]

The Psychology of Shift Work.

In your issue of the 3rd inst., Mr. A. H. Holt, in his letter on "The Psychology of Shift Work," suggests as a possible remedy of its evils, the formation of a Staff Engineers' section of the E.T.U.

This, I am proud to say, to all intents and purposes already exists, Station Engineers' Branches having been formed in London (three), Manchester, Glasgow, and Birmingham, and they are under consideration, if not already actually formed, in many other large towns.

Speaking for Birmingham, this branch caters for and includes a very large number of staff engineers, and I strongly advise Mr. Holt to get in touch with the Manchester Branch.

Birmingham, *August* 13*th*, 1917. **Thos. N. Morris,** *Secretary, Electrical Trades Union.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Large Lifting Magnet.

An improved Phœnix lifting magnet, 62 in. in diameter, recently tested at Messrs. STEEL, PEECH & TOZER'S works, unloaded a truck-load of steel turnings in 7 minutes, which work ordinarily takes four men five hours to do; it filled four large furnace boxes in four lifts with 3½ tons of metal; a truck load of tube scrap, weighing 7 tons 7 cwt., was emptied in 6¼ minutes. It is considered that the magnet would lift a solid ingot weighing 70 tons. The magnet

weighs 65 cwt. and requires about 50 amperes at 220 volts; the controller enables the load to be partly discharged if desired, and a safety device can be fitted to ensure the load being maintained even if the main current is interrupted.—*Iron and Coal Trades' Review.*

Pocket Lamps.

Amongst a variety of designs for pocket lamp cases, Messrs. Rose Bros., of 25, Milton Street, E.C. 2, have introduced a "trench lamp" finished in khaki enamel, in which light is obtained only by lifting the top, as here illustrated. Short-circuiting is impossible. This case takes the standard three-cell battery. It will be

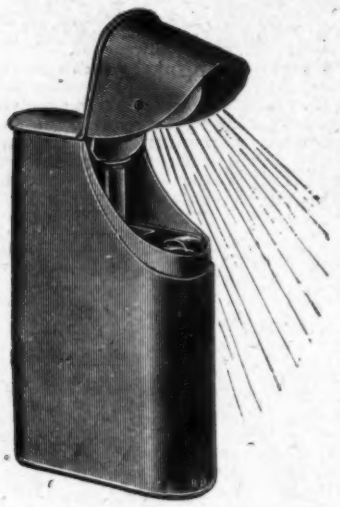


Fig. 1.—Trench Lamp.

noticed that the top forms a hood over the lamp, preventing the escape of the rays in undesirable directions, and there is no possibility of the battery being accidentally run down by pressure on the lamp in the pocket. They are also making a pocket accumulator lamp, in which the cells are packed with glass wool; when the cells have been charged, the acid is drawn off, making the lamp unspillable. Other items, in addition to their usual lines, are new types of medical coils and a stock of general accessories, bell-wire, &c.

A Large Self-cooled Transformer.

Oil-insulated, self-cooled transformers contained in fluted tanks were, until recent years, limited to about 500 kw. capacity, and units larger than this were usually of the oil-insulated, water-cooled or air-cooled type. However, with the development of the outdoor sub-station there was created a demand for large transformers that would operate in any climate and under all kinds of

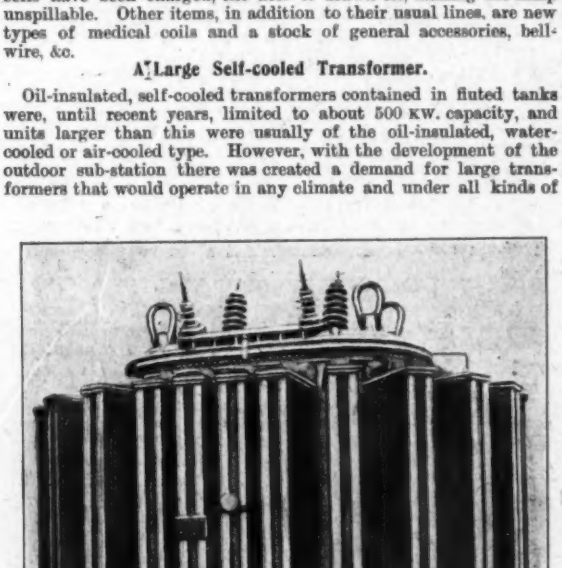


Fig. 2.—Radiator-tank Type Outdoor Transformer.

weather conditions without an attendant. This gave new life to the self-cooled oil-insulated type of transformers, and new designs were developed. The result is that the sizes of self-cooled oil-insulated transformers have been increased until they have reached the proportions of the one shown in the illustration. This unit is said to be the world's largest self-cooled transformer, and was built by the General Electric Co., Schenectady, N.Y. Six of these units have been constructed for the Carnegie Steel Co. They are single-phase, 25-cycle, 8,000-k.v.a. each, giving a total capacity of 48,000 k.v.a., and step the voltage down from 44,000 to 6,600.

The unique feature of these transformers is the construction of the external radiators, which consist of a number of vertical flattened tubes rigidly welded into headers which are flanged for bolting to the tank. The 24 radiators give a radiating surface of 800,000 sq. in. As the oil is heated in the containing tank, it rises to the top of the tank and out into the radiators, while the cool oil flows in at the bottom, thus producing automatic circulation of the oil through the radiators. All seams and joints in the tank and radiators are welded to prevent oil leaking. The radiators are self-draining and have no pockets, preventing the accumulation of air at the top or moisture and sediment at the bottom.

The transformer winding is of the circular-disk-coil interleaved type mounted on the centre leg of a three-legged core.—*Elec. World.*

Indian Ink Eraser.

An eraser has been introduced with which Indian ink can be completely cleaned from tracing cloth. It is claimed that it leaves no trace of the ink, and does not injure the cloth. The article is being sold and manufactured under the trade name "Rasindia," by Mr. E. H. Anderson, at 272, East 199th Street, New York, U.S.A.

LEGAL.

Alleged Unlawful Possession.

At the Mansion House Police Court on the 10th inst., Wm. James Mansell 33, an electrician of Woodley Road, Stoke Newington, was charged, on remand, before Sir John Knill, with being in the alleged unlawful possession of one electrolier, an electric standard, and fittings, supposed to have been stolen.

Mr. Henry Wells, acting secretary of the General Electric Co., Ltd., said the fittings were of their manufacture, but he could not say that they had been stolen from them.

Mr. Douglas (Chief Clerk): Do you sell wholesale or retail?

Witness: Wholesale. They had not got prisoner's name on their books as a customer. The value of these articles was about £9.

Sir John Knill said he was satisfied that prisoner was not honestly in the possession of the articles, and sentenced him to 14 days' hard labour.

General Electric Co., Ltd., and the British General Electric Co., Ltd., v. J. Ossawa & Co.

According to a Sydney newspaper, on June 22nd, in the Australian Courts, Mr. G. E. Flannery appeared for the plaintiffs, and Mr. F. R. Jordan for the defendants, of York Street, Sydney, in this matter, in which the plaintiffs applied for an injunction restraining the defendants from infringing the former's trade mark.

His Honour made the following orders in terms of the statement of claim, viz.:—(1) That the defendants be restrained from infringing the trade mark on certain electrical apparatus of the plaintiff, the General Electric Co., Ltd.; (2) that the defendants be restrained from passing or attempting to pass the defendants' goods as the plaintiff company's goods; (3) that the defendants deliver up all apparatus in their possession which offend against the above injunction.

Refusal to Grant a Leaving Certificate.

The refusal of the Bristol Corporation to grant a leaving certificate to H. J. Bridge, a wireman employed in the sales department of the electricity department, formed the basis of an appeal to the Bristol Local Munitions Tribunal, when the chairman of the Tribunal found that reasonable grounds had been established for the withholding of the certificate. The complainant alleged that the Corporation acted unreasonably in refusing the certificate, inasmuch as they did not comply with the Fair Wages Clauses; he was an electrical fitter, a member of the A.S.E., and was paid at the rate of 11d. an hour for 53 hours, which was equal to a wage rate of 45s. 10d. per week of 50 hours; in addition, he received a 4s. war bonus. The district rate for an engineer's fitter in a "shore shop" in the Bristol district had been 50s. a week of 53 hours since the award of the Committee of Production, which came into operation on April 1st, 1917. The complainant contended that there was no distinction in that district between an electrical fitter and any other fitter, and that the rate should be 50s. a week of 53 hours.

The respondents contended that the engineers' rate above-mentioned was not applicable to their establishment; the work done was similar to that of the local electrical contractors, whose electrical fitters were paid at 10d. an hour for a 50-hour week; and as they were paying complainant 11d. an hour, they were paying more than the district rate, and therefore complying with the Fair Wages Clauses; also the award of the Committee of Production had no application to their establishment.

The judgment stated that the award did not apply to the shops of electrical contractors, and that the respondents had not

infringed the Fair Wages Clause; they had reasonable grounds for refusing a certificate to the complainant, and the complaint was dismissed.

Colliery Electrician Fined.

At the Wigan County Police Court, on August 3rd, Clifton Ramsdale, electrician, was summoned by the Wigan Coal and Iron Co. for failing to examine electrical apparatus at a mine. Mr. T. Ellis appeared to prosecute, and said the defendant was employed by the prosecuting company as an electrician. On July 9th the defendant should have inspected Aspull Moor pumping pit, but he said some men were employed in the pit shaft, and therefore he could not make the examination. That might have been so, said Mr. Ellis, but defendant could quite easily have reached the apparatus another way. He entered in his log-book that an examination had been made, and made the entry "All in order" for that date. A fine of 40s. was imposed.—*Wigan Observer.*

South London Electric Supply Corporation v. Charles A. Burbrook.

At Lambeth County Court, before Judge Hodges, last week, the South London Electric Supply Corporation brought an action against Charles Alfred Burbrook, of 19, Bellevue Gardens, Clapham Road, to recover £4 4s. 2d. for fixing electrical fittings. His Honour gave judgment for the plaintiffs for £3 14s. 8d., with costs.

South London Electric Supply Corporation v. Mrs. L. Bowman.

At Lambeth County Court, before Judge Hodges, last week, the South London Electric Supply Corporation brought an action against Mrs. Bowman, of 31, Athenfold Road, Clapham, to recover 11s. 6d. for work done.

Defendant's daughter stated that the fittings were damaged when they went into the flat, and her mother was not responsible for their repair. When the inspector called his attention was drawn to them, and he said he would send a man to do the work.

Judge Hodges: You would not have had them repaired if you knew you had to pay for them?

Witness: No.

Judge Hodges said he thought a mistake had been made, and gave judgment for the defendant, with costs.

A Defective Portable Lamp.

At Falkirk, on Monday, before Sheriff Moffatt, the Greenock and Grangemouth Dockyard Co., Ltd., Grangemouth, were charged with having on June 7th in their yard, being a factory to which the Factory and Workshops Acts applied, allowed a portable electric lamp to be used by a ship's caulker, now deceased, on board a ship under construction, the lampholder of which was in direct metallic connection with the guard, contrary to the Electricity Regulations, and particulary Regulation 13.

Evidence was given for the prosecution that there was no doubt the lamp which the deceased caulker had used was a violation of the regulations. For the defence, evidence was given by several witnesses, including the company's electrical engineer, that a large number of caulkers and riveters had been drafted from Glasgow in order to expedite the work of a particular ship, and the wastage of portable lamps on that ship was extraordinary. Several of the damaged lamps were produced in Court. One witness deposed that he had seen the lamps wilfully thrown at workmen, and he had also seen them placed in position as targets, and washers and nuts thrown at them. The workmen also wasted their employers' time, for when new lamps could not be provided they remained idle until the broken ones were repaired.

A representative from a Glasgow firm of makers spoke to supplying lamps to the company which did not conform to Regulation 13. The lamps were cheaper in the proportion of 2s. 9d. to 7s., and they did not question an engineer's order.

The Sheriff found the defenders guilty, and imposed a fine of £3. He remarked that he was impressed with the difficulties of the company in carrying out work of vital and great national importance. It would never do for the company to stop work because they could not obtain lamps which conformed to the Government Regulations. That was not common sense, and it might be a question whether representation should not be made to the Home Secretary to have the Regulations made easier at such times. There seemed to be no doubt about the wilful breaking of lamps, and the desire of the workmen to waste their employers' time. He trusted that no such evidence regarding workmen would be given in that Court again, and thought that if the men could be found who had committed the damage alluded to, they should be severely dealt with.

The Metric System.—The British Chamber of Commerce in the Argentine, which has a membership of over 250 British companies and merchants trading with the Argentine, has sent a memorial to the Prime Minister stating that, in the opinion of the Chamber, it is highly desirable, in the interests of British trade abroad, that the decimal metric system of weights and measures should be made compulsory throughout the Empire forthwith.—*Times Trade Supplement.*

WAR ITEMS.

Exports to Switzerland.—The "London Gazette" announces that, by Order in Council, the exportation to Switzerland of celluloid wares, insulating materials, pressspahn, and tin wares, with other items, has been prohibited.

Trade with China.—The "London Gazette" for August 10th contains a list of additional firms in China and Siam to whom articles may be exported.

Australia.—The Federal Government has revoked the ban placed by the Federal Attorney-General, under the provisions of the Enemy Trading Act, on the Sterling Telephone and Electric Co., Ltd., and Conrad William Schmidt.

Exports Prohibited.—The "London Gazette" for August 14th contains amendments to the schedule of articles of which the exportation is prohibited. Amongst the additions to the schedule are the following:—Malleable castings—chain fittings, conduit fittings, lamp fittings, pipe flanges, stove fittings, tramway fittings; chemicals—mixtures and preparations containing ethylic alcohol; manufactures of raw hides—pinions, &c., suitable for textile machinery; metal valves of all descriptions.

Foreign-Controlled Companies.—The fourth report of the Enemy Influence Sub-Committee of the Unionist War Committee has just been issued. It deals with the disclosure of the identity of foreign-controlled companies. The report mentions that in deciding what steps should be taken to prevent foreign-controlled companies in the future from passing themselves off as British concerns, care must be taken not to discourage the investment of foreign capital in the business of this country. The Sub-Committee expresses the opinion that it would be reasonable to require that where a company or corporation carrying on business in the United Kingdom is actually under foreign control, unless the existing title of the company clearly and correctly designates its foreign nature, the fact should be disclosed in its title by adding the words "foreign-controlled," so that everyone having dealings with it, and the public generally, may be aware of such foreign control. In order to ensure the observance of the law, the Sub-Committee recommends that the directors and secretary of every company or corporation should be required to make proper returns, stating the position of the company, to the Board of Trade.—*Financial Times.*

Air-Raid Warnings.—Sir G. Touche asked the Home Secretary whether he was aware that, following the intimation that electric power stations desiring to receive telephonic air-raid warnings by day, such as had always been given by night when there was less risk to machinery and fewer hands employed, should apply to the police authorities, the Associated Municipal Electrical Engineers of Greater London made application, and received a reply suggesting that the object would be met by the arrangements for giving a general public warning when enemy aircraft were reported to be approaching the London area; if he was aware that the public warning was rendered inoperative in the works in consequence of the noise of the machinery and other causes, and if he would reconsider the refusal to give direct warning by day as well as night.

Mr. Pratt said the application from the electrical engineers was received before arrangements were made for a public warning in London, and when the public warning had been arranged for it was suggested that it might suffice for their purposes. He had not received any representations to the contrary from the Association, but he was communicating again with the Association.

Trade Within the Empire.—The Prime Minister has appointed a Committee of Ministers to report on the best methods and machinery by which to give effect to the resolution passed by the Imperial War Conference in favour of special facilities being accorded for the exchange of the products and manufactures of the Empire. It is understood that the Government departments which will be represented on the Committee, of which Mr. Walter Long is chairman, are the Treasury, Foreign Office, Colonial Office, India Office, Ministry of Reconstruction, Board of Trade, Ministry of Shipping, Board of Agriculture, and the Ministry of Labour.

Employment Exchanges.—The Civil Service Correspondent of the *Daily Telegraph* states that Mr. Hodge, Minister of Labour, has decided on a new scheme which will have an important bearing on the future usefulness of the Employment Exchanges, and undoubtedly will commend itself to employers and workers. Over the United Kingdom, until now, only about 20 local advisory committees have been established. In future there will be an Advisory Committee attached to each exchange. The committees will be empowered to discuss anything they choose, and to advise and make suggestions as they think fit. It is estimated that about 300 of these Advisory Committees will be set up all over the kingdom. London will have one Central Committee, but with sub-committees in close touch with each exchange. Under Mr. Hodge's scheme all trades and industries will be represented in one omnibus committee, composed of one-half employers and one-half workers.

Labour Disputes.—Numerous resolutions, it is stated, have been received by the Executive Council of the Amalgamated Society of Engineers from branches and district committees expressing dissatisfaction at the inadequacy of the Committee of Production's award relative to the wages in the engineering and foundry trades. As the result, the Executive Council has sent a letter to the Committee on Production, in which it states it is essential that the Committee should be made conversant with the state of feeling manifesting itself throughout the country among the members with reference to the award, as they deem the advance of 3s. a week totally due to the increased cost of living. The executive has received a communication from Dr. Macnamara to say that the Board of Admiralty has decided that the award shall be applied to workmen in the Royal dockyards, and that instructions have been issued to that effect.—*Daily Telegraph.*

Exemption Applications.—At Rochdale, Mr. G. Webster, tramways manager, appealed for J. Crossley (36, Class A, single), electric wireman, and four married motormen, three Class A and the other B 1, and all under 32 years of age. Mr. Webster said he had lost 43 drivers out of 88, and was still 14 short. He was trying to obtain substitutes wherever possible. Crossley was conditionally exempted, and the others put back to November 15th.

At Burnley, an electrical engineer, now in the Army, appealed for an engineer, married, 29, C 1, but previously rejected. Exemption to September 30th was given.

At Slough, the Military appealed against absolute exemption held by W. C. Hayward (38, A 1), electrician. Hayward was stated to have entire charge of an electric plant. Appeal allowed, certificate cancelled, and three months' temporary exemption allowed, with no further appeal without leave.

At Hereford, Messrs. Harding Bros. appealed for H. C. Owens, electrician; exemption until October 15th.

At Hastings, Mr. Wordley appealed for R. C. Merrifield (40, A 1), electrician, and a member of the Fire Brigade; three months' conditional exemption.

At Rawmarsh, the Mexborough & Swinton Tramway Co. appealed for the retention of two motormen; one, aged 28, had his exemption confirmed; the other appeal, referring to a discharged soldier, was deferred for further information.

An appeal was made by the Military to the Herefordshire Appeal Court for J. Langford (33, B 1), electric light attendant, who had been exempted locally. Respondent was put back to October 1st, with an examination by the Central Medical Board in the meantime.

At Oldham, exemption was claimed for a Corporation tramcar driver (32, B 1). It was stated that he was 22 days below the age limit for men employed on work of public utility. He was given exemption until November 1st.

At High Wycombe, an appeal was lodged by E. H. Milner (39, C 1), electrical engineer; on his remaining a Special Constable, he was given three months' temporary exemption.

At Castleford, the Military appealed against exemption held by C. J. Cox, electrical engineer, passed for general service. Several firms wrote stating that they were dependent upon Mr. Cox for repairs, &c., and the appeal was disallowed, and the exemption allowed to remain in force.

At Gloucester, conditional exemption was conceded to an electrician (20, C 1), said to be the only man left capable of looking after the plant at several theatres. The Military representative intimated that he would appeal against the decision.

Before the County Appeal Court, exemption was claimed by Mr. Albert Willcox (39, C 2), electrical engineer, of Farnham Common. It was certified by the Acting Tuberculosis Officer of the Bucks. County Council that appellant had tuberculosis of the lungs. Six months' temporary exemption was granted.

BUSINESS NOTES.

Electrical Trade with the British West Indies.—The following particulars of the imports of electrical goods into the British West Indies and British Guiana are taken from a report by the Canadian Trade Commissioner at Barbados, which is published in the July 2nd issue of the "Weekly Bulletin" of the Canadian Department of Trade and Commerce:—

Although electricity has been introduced into Barbados, Trinidad, British Guiana, and Jamaica, for lighting and for power for tramways, it has not come into general use, and there is a wide field for its expansion for lighting and domestic purposes. For the whole of the West Indies the value of the imports of electrical apparatus and fittings amounts to only £35,000 a year. This, however, does not include machinery or the large quantity of copper wire required by the tramway, electric lighting, and telephone companies. The value of wire used considerably exceeds the value of electrical apparatus. Of the requirements for electrical goods of all kinds, the United States is at present the largest supplier, but the bulk of these goods came from the United Kingdom previous to the war. The United States has now practically all the trade of Trinidad and Bermuda, about two-thirds that of Jamaica, and more than half that of British Guiana. The United Kingdom comes next, supplying the greater part of the trade of Barbados, about one-third of that of Jamaica, and practically all the trade of the Windward and Leeward Islands.

There are only three cities in the West Indies that have electric tramway services, namely, Kingston (Jamaica), Port of Spain (Trinidad), and George Town (British Guiana). It is understood that after the war the existing mule tramway system in Barbados will be replaced by an electrical system; the rails and some of the machinery required have already been imported.

Electric motors are being gradually introduced into the larger sugar factories, engineering establishments, cotton ginneries, and also for dental and other minor purposes where electric current can be obtained. In the last few years electric fans have been installed in the principal commercial and public offices. In all the principal hotels and private residences electric bells are now fitted.

Throughout the larger islands complete telephone systems are to be found.

As regards the electric fittings used in the West Indies, &c., it is to be noted that the electric lighting system in Barbados follows the British practice in using the bayonet type of lampholder, but in British Guiana, Trinidad, and Jamaica, the American screw-base type is in use.

In the Windward and Leeward Islands electricity has not been introduced to any extent. Attempts to introduce electric cookers into the larger islands have, up to the present, met with little success.—*Board of Trade Journal.*

Catalogues and Lists.—Messrs. Sterns, Ltd., Royal London House, Finsbury Square, E.C. 2.—Leaflet relating to "Balagrip Bricks" for balata belts, and "Excelsior Sterneline" for use in screw and automatic lubricators.

The Credenda Conduits Co., Ltd., Birmingham.—Three showcards executed in colours, showing "Creda" electric fires in the nursery, in the bathroom, and in the trenches—very effectively.

Messrs. Rose Bros., 25, Milton Street, E.C. 2.—Special catalogue of pocket lamp cases, pocket accumulator lamps, dry batteries and accumulators, bulbs, &c.

Book Notice.—"Science Abstracts." A and B, No. 235 Vol. XX, Part 7. July 30th, 1917. London: E. & F. N. Spon Price 1s. 6d. each net.

Bankruptcy Proceedings.—Frederick Brown, 8, Stafford Street, Llanelly.—Order of discharge, as from July 6th, 1919.

G. J. T. J. Parfitt, 11, Priory Road, Keynsham.—Notice is given of intended dividend. Last day for receiving proofs, August 28th, 1917. Official Receiver, Mr. C. H. King.

Private Arrangements.—Basil Charles Cousens, 81, Bold Street, Fleetwood, and 6, Albert Square, and Wyre Dock, Fleetwood, electrical instrument maker.—A meeting of the creditors was held at Preston, when a statement of affairs was submitted showing liabilities totalling £1,484. The net assets were £895, disclosing on paper a deficiency of £589. It was stated that the debtor had, owing to proceedings and judgment, consulted his solicitor a few days before the meeting, and it had been considered desirable to protect the assets for the benefit of all concerned. Owing to his being engaged on Government work he was not present at the meeting. There was no offer before the meeting, but several creditors expressed the opinion that it would be better if the debtor could make some proposal. It was decided to confirm the deed already executed in favour of Mr. Todd (Preston), a Committee of Inspection being elected. The following are the creditors:—

British Thomson-Houston Co.	£27	Falk, Stadelmann & Co.	£13
"Bankers"	286	Great Grimsby Salt Co.	16
Bowcock & Wilkinson	57	Heath & Co.	91
Baxendale & Co.	18	Munroe & Co., Ltd.	11
Baxendale Bros., Ltd.	486	Mason, J. W., & Co.,	23
Cookson, Ltd.	14	Penman, Dr.	16
Close, Albert	33	Preston & Sons, Ltd.	13
Callender's Cable Co.	83	Potter, John	23
Edelshaw & Sons	16	Parkinson, N.	14
Fleetwood Trawlers	14	Whittington & Wilson	16

Fire.—Considerable damage was caused by an outbreak of fire at Silvertown early on Saturday morning at the Winchester Street Works of the India-Rubber, Gutta-Percha, and Telegraph Works Co. The outbreak was discovered in a huge building of four floors, and, owing to the inflammable nature of its contents, the two upper floors were quickly involved.—*Financial Times.*

Advance in Prices.—The Sterling Telephone and Electric Co., Ltd., announce that from the 13th inst. all list prices are further advanced 20 per cent., with certain specified exceptions.

Liquidation.—Korting Bros., Ltd., 53, Victoria Street, London, S.W. 1.—This company has gone into voluntary liquidation for the purpose of getting rid of all enemy connections. The business has been sold as a going concern, with all assets and liabilities, to a new company under the name of Korting Bros. (1917), Ltd., which will carry on the business as an entirely British concern, at the same address.

Company Directors.—The B. of T. has published in the *London Gazette* of August 14th a schedule prescribing the form in which the particulars required by Section 2 of the Companies (Particulars as to Directors) Act, 1917, are to be sent to the Registrar of Companies, and an amended form to be used in making the list of members and summary of capital required by Section 26 of the Companies (Consolidation) Act, 1908, as amended by the former Act.

Trade Between the United Kingdom and Canada.—The Imperial Trade Correspondent at Winnipeg (Mr. W. J. Healey) reports that the Winnipeg Board of Trade (*i.e.*, the Chamber of Commerce) has appointed a new Standing Committee with the object of promoting trade between the United Kingdom and Canada. This Committee, which is to be known as the Imperial Trade Committee of the Winnipeg Board of Trade, is prepared not only to answer all questions by British manufacturers bearing on the trade within the Empire, but to receive, and have properly displayed, samples from any British manufacturer. By this means, it is thought, importers in Western Canada will have an opportunity of handling British-made goods which are suitable for that territory. Samples submitted can usually be sold, and the proceeds, less a small commission to cover incidental expenses, remitted to the exporter. The Committee will also endeavour to establish connections between the importer and manufacturer, or the importer and agent. Communications from the British firms should be addressed to the Secretary, Imperial Trade Committee of the Winnipeg Board of Trade, Winnipeg.—*Board of Trade Journal.*

Trade Announcement.—Messrs. Grindlay, Ross, and Co., Ltd., Glasgow, announce their removal to Adelphi Engineering Works, Reid Street, Bridgeton, Glasgow. Telephones: Bridgeton 1721 and 1722. Telegrams: "Grindlay," Glasgow.

Plant for Sale.—Nuneaton Corporation has for disposal a complete electrical plant, suitable for a private installation. Full particulars are given in our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Australia.—Consideration is being given by the Sydney City Council to the question of acquiring a coal mine to provide coal for the municipal electric supply station. A coal-bearing property is being investigated.—*Melbourne Age.*

The Sydney City Council has been advised that the High Commissioner for Australia has been notified that it is impossible to sanction priority for a steam turbine plant for the Council, and suggesting that the Council should reduce the supply of power to private customers, and thus provide adequate supply for national and public purposes.

Balls Head, Sydney, N.S.W., is to be transformed into the largest coaling depôt in the Southern Hemisphere, at a cost of about £500,000; stocks of coal of 50,000 tons and upwards will be carried, as well as stores of oil fuel, &c. The colliers will be discharged by mechanical grabs, and the coal sent to the stacks by means of electrical conveyor belts. Electrical weighing machines are included in the plant, and will work in conjunction with the conveyors.—*Colliery Guardian.*

The Wollongong Council has been informed by the Public Works Department that a feeder can be run from the Port Kembla—Cordeaux transmission line, enabling an electric supply scheme to be started.—*Sydney Evening News.*

The Warrnambool (Vic.) T.C. and Water Trust has decided to provide for a future municipal electricity supply in the town by installing new 150-H.P. high-speed engines at the water supply pumping station; until the electric supply is installed, the new plant will be utilised for pumping only.—*Melbourne Age.*

Bacup.—At a meeting of the T.C., Councillor J. H. Lord said there was a general satisfactory increase month by month in the demand for electricity; they had not been able to meet the Rawtenstall Corporation with regard to the question of a bulk supply, but were asking for a conference, so that the matter might be settled.

Canada.—In a recent article, by Mr. W. R. Bonnycastle, in the *Electrical News*, the author draws attention to the power requirements of Vancouver City, advocating that the city should secure a power site at Bridge River, 138 miles away, where an operating head of 1,400 ft. could be obtained, and, with storage facilities, 500,000 H.P. could be developed. The cost of the development would be $45 per H.P. at the power house, and at Vancouver $70-90, depending on the energy delivered. This development could supply a large portion of the province, and is said to be considerably less costly than those proposed for Winnipeg.

A company is erecting a large plant at Shawinigan Falls, Quebec, for the purpose of manufacturing carborundum and other abrasives. A contract has been made with an electric power company to supply 20,000 H.P. to the new enterprise. It is expected that the construction of the plant will be completed by the end of the year, and that a staff of 300 men will be employed at first.

Colchester.—Proposed New Station.—The Electricity Committee has under consideration a scheme for erecting and equipping a generating station on the river; the existing works would be converted into a main distribution sub-station.

Continental.—Spain.—In discussing the future of the electro-chemical and electro-metallurgical industries in Spain, *La Energia Electrica* concludes that the principal Spanish rivers and their feeders could supply 1,200,000 H.P. for their development, of which only 400,000 H.P. is at present utilised.

The Sociedad Hidroelectrica del Pindo has been granted the use of the whole of the water power obtainable from the River Dobra, Orviedo Province, for utilisation for industrial purposes.

Greasbro'.—Provisional Order.—The U.D.C. has decided to make an application to the B. of T. for a Provisional Order to authorise the supply of electricity for public and private purposes within the urban district.

Hereford.—Electricity Prices.—The Electricity Committee has recommended that, with the exception of reverting to the previous daylight schedule of prices, plus the advances, it will be unnecessary to raise the prices of electricity further. The Finance and General Purposes Committee had recommended increased charges to all classes of consumers.

Harrogate.—The T.C. is endeavouring to get permission from the military authorities to keep all the public electric lights in operation during the coming winter.

Boiler By-Product Plant.—The Electricity Committee has recommended the Council to make application to the L.G.B. for sanction to borrow £4,710 for the installation of a by-product steam boiler plant, in accordance with the designs and specifications of the borough electrical engineer.

India.—Electric Power in Collieries.—The collieries of India, and especially those in Bengal, have, during the past few years, been gradually adopting electricity as a motive power in place of steam. Companies owning a number of collieries have recently effected an economy by installing units at a central station and distributing electricity to the various collieries.—*Colliery Guardian.*

Leeds.—Proposed Loan.—Application has been made by the Electricity Committee to the L.G.B. for powers to borrow a sum of £25,000 for mains extensions, and also a similar amount for the erection and equipment of sub-stations.

London.—Marylebone.—The general manager of the electricity supply department reports that the output of electricity for the four weeks ended July 26th last was 878,150 units, as compared with 836,900 units during the corresponding period of 1916.

Manchester.—Electric Cooking and Heating Appliances.—In the current year's estimates of the Corporation's Sanitary Committee, £250 is provided to cover the expenditure of the Air Pollution Advisory Board for chemical analysis and research work in connection with electricity, gas, and coal cooking, and heating appliances. The Committee reported that an application had been made to the Committee of the Privy Council for Scientific and Industrial Research for a grant in aid of the work, and that a reply had been received stating that the Privy Council had promised the sum of £150, subject to certain conditions.

Marsden.—The U.D.C. has considered a letter from the Yorkshire Electric Power Co. on the lighting question, and a special meeting is to be convened to discuss the matter with the company.

Middleton.—Bulk Supply.—The Corporation has had under consideration the report of the electrical engineer on the proposal to convert the electricity works into a transformer and distribution station to deal with a bulk supply of electricity from Manchester, stating that under the proposed arrangement an increased output of 70 per cent. above the capacity of the present plant could be immediately provided to meet the future demands, and an estimated saving in wages, maintenance cost, and repairs, &c., of over £900 per annum could be effected, whilst the saving in the amount of coal consumed in the generation of the electricity at Manchester, as compared with Middleton, would be 1,500 tons per annum. The town clerk has been instructed to communicate with the Coal Controller on the matter.

New Zealand.—The revenue of the Auckland Corporation electricity department for last year was £60,326, and the gross profit was £34,033. In his annual report, the city electrical engineer states that there was an increase of 10 per cent. in the output as compared with the previous year, which would have been much greater if conditions had been normal and materials available.—*Auckland Weekly News.*

Perth.—Price Increase.—The Corporation Gas and Electricity Committee has agreed to recommend an increase in the gas rate, and an all-round increase of 40 per cent. on the electricity rates.

Peterborough.—Price Increase.—The T.C. has decided to further increase the price of electricity, as from September 30th, by 10 per cent., making a total additional charge on the pre-war rates of 20 per cent., and to notify the Electric Traction Co. that the rates paid for current are to be revised three months hence.

Sheffield.—Arrangements have been made for the transfer to Sheffield of 28,000 KW. of plant which is to be installed in the emergency power house at Blackburn Meadows, and the general manager has been authorised to place contracts for the necessary machinery, boilers, and works, at a total estimated cost of £560,000. This includes plant, &c., already ordered. Mains are to be extended at an estimated cost of £2,092.

Sunderland.—The T.C. has decided against the recommendation of the Electricity Committee that the services of the borough electrical engineer should be temporarily lent to the B. of T. Coal Mines Department.

The T.C. has decided that no services for the supply of electricity be laid unless the consumer first provides a priority certificate of a sufficiently high category to enable the Electricity Department to purchase the material required for the work.

Tasmania.—According to the *Melbourne Age*, the Lake Margaret hydro-electric plant is to be extended by the Mount Lyell Co., so as to make available 8,000 H.P. additional to the present installation, at a cost of about £70,000, the aggregate expenditure in this connection being approximately £230,000. At the request of the Government, the Mount Lyell Co. has investigated a scheme for generating electricity on the King River. The results indicate that it appears "economically feasible" to install a 30,000-H.P. plant. Additional power from the Lake Margaret installation will, in the first instance, be used for the electrolytic production of speller.

Whitworth.—The Council has been in communication with the Rochdale Tramways Committee, with a view to obtaining electricity from the overhead wires for street lighting purposes, and has been informed that the scheme would be impracticable, as the voltage in the wires varied considerably, and at times was very low.

TRAMWAY AND RAILWAY NOTES.

Australia.—The Brighton (Vic.) Council has decided to apply for an Order in Council authorising the construction of electric tramways in its territory.

According to the *Melbourne Argus*, the net profit of the Melbourne Tramways Board for the first year's operating of the cable tramway system will be about £350,000. Last year, under the Melbourne Tramway Co.'s management, the revenue from traffic was £805,000; this year the total earnings will be, approximately, £841,000, and with earned interest and income from other sources £857,000. Though the income of the Tramway Board will be considerably more than was received by the Tramway Co., its expenditure will be heavier, as wages, fuel, &c., have considerably increased, and the law costs, consequent on the arbitration proceedings over the purchase of the Melbourne Tramway Co.'s cars and other equipment, will mean additional expenditure. The Tramway Co. last year paid £312,000 in dividends, and transferred £97,858 to reserve, &c. The Board will probably be able, with an extra income of approximately £35,000 for the year, to meet the increased cost of labour and materials and show a net profit of about £350,000; these accumulated profits will be invested until such time as Parliament directs what shall be done with them.

Bradford.—Traffic Receipts.—In the week ended August 4th, the receipts on the Corporation tramways were £7,653, an increase of £299 on the corresponding week of last year. For the 126 days of the current year the income has been £137,631, an increase of £12,620 on the corresponding period (127 days) of last year, whilst last year's figure was an increase of £270 over 1915.

Continental.—Spain.—The installation of mechanical communication between Coruna and Santiago has been mooted for over 20 years, and now active steps are being taken to realise a scheme. A company has been formed to construct an electric tramway to link the two cities, the funds being provided by prominent individuals in both the provinces in which the cities are situated.

A company is in course of formation for the construction of an electric tramway in the Asturias, the Diputacion and Municipalities of Oviedo, Norena, and Pola de Siero having agreed to make a yearly subvention of 70,000 pesetas for 10 years.

Doncaster.—The Corporation tramway receipts for the four days of the Bank Holiday period totalled £764, as against a total of £439 last year. The Bank Holiday Monday figure was exceeded by the Saturday total of £286, which was a record day in takings.

Leeds.—The tramway receipts for the week ended August 4th were £10,719, an increase of £94 over those of the corresponding period of last year. The passengers carried were 2,320,000, an increase of 35,000. The receipts for the 18 weeks of the current financial year have been £197,943, an increase of £20,414 over the corresponding period of last year.

Women Inspectors.—The threatened trouble on the city tramways, owing to the appointment of six female inspectors, has been settled. The female inspectors are to be retained, but the Tramways Committee undertakes to appoint as future inspectors, former employés who return from the Army but are unfit for drivers, if they are suitable for the work, or other male employés. In any case, the appointments are but a war-time measure.

Manchester.—Traffic Congestion Scheme.—The Special Committee of the Corporation, which has been considering the question of traffic congestion in the central area, has prepared a scheme which will be submitted to the City Council at the September meeting; the scheme provides for the laying of two new tramway tracks to ease the severe congestion in Piccadilly, London Road, and Oxford Street, provision of tramway terminals, and the purchase of property, &c., estimated to cost between £1,000,000 and £1,500,000.

Manchester and Salford August Holiday Traffic.—The three days' receipts of the Manchester Corporation tramways were £10,921, against £9,763 for the corresponding period in 1916 and £8,803 in 1915. The 1917 daily figures were:—Saturday, £4,106; Sunday, £2,480; and Monday, £4,335; while Salford's tramway receipts for the same period amounted to £5,313, against £3,084 in 1916.

Newport (Mon.).—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order made by them for the construction of a light railway.

New Zealand.—The Wellington City Council has decided, owing to the shortage of labour, to adopt a scheme for the curtailment of the tramway services, and to impose a minimum fare of 3d.—*Auckland Weekly News.*

Sheffield.—The Overhead Line Superintendent (Mr. S. W. A. Sturman) is to act on a Committee of Overhead Line Engineers, which is to consider the question of standardisation of overhead line materials. The Committee has been appointed by the Municipal Tramways Association. The general manager has disposed of five sets of second-hand magnetic brake fittings, taken off cars purchased from the London County Council, to the Rotherham Corporation Tramways, at £10 per set.

The Corporation Tramways Committee has considered the question of wages to be paid to women engaged as labourers in the car repair shops at the Queen's Road works, and authorised the payment of the same rate per hour—viz., 6½d.—as is paid to the men, plus the amount of war allowance paid to the women of 7s. per week.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—On June 23rd, Mr. Justice Powers made known his award in the plaint of the Commonwealth General Division Telephone Officers' Association against the Public Service Commissioner and others. The proposed award is that the rates of pay shall be:—Telephonists, first year, £54; second, £72; third, £90; fourth, £102; fifth, £114; sixth, £126, with a further sum of £6 a year to all who have acted as telephonists for six years or more, and are employed in central exchanges in capital cities to do trunk-line work. Telephonists of 21 years and over shall be paid a minimum of £110. Monitors, first year, £150; second, £156; third, £162; fourth, £168; fifth, £174. Supervisors, first year, £180; second, £186; third, £192; fourth, £196. Telephonists at work in any central city exchange between 10 a.m. and 6 p.m. shall not be required to work for any time exceeding 3½ hours without a break of 10 minutes, or a break for meal, or exceeding 2½ hours if they are required to stand continuously at their work. All work performed in excess of the roster hours of duty in any one week shall be deemed overtime, and paid for at the rate of time and-a-half. For duty on Sundays, officers shall be allowed a day off in the next week, and half a day's pay shall be paid at the rate of time and-a-half. For duty on holidays, officers shall be paid at the rate of double time, but not double time in addition to the ordinary pay for holidays. The award will not come into operation until the expiration of 30 days after it has been laid before the Commonwealth Parliament.—*Sydney Morning Herald.*

Fleetwood.—At Fleetwood Petty Sessions, on August 9th, G. Kearsley, E. Banks, L. Eaves and F. Stanton were summoned for damaging telegraph insulators by throwing stones. Kearsley was fined £5, Banks £1, Eaves £1, and Stanton 5s.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Keighley.—August 21st. B. of G. Electric fittings and accessories for lighting the main block at the infirmary. Mr. S. Green, Clerk to the Guardians.

Kettering.—August 28th. Electricity Department. Supplying and laying 754 yards of lead-covered cable, with three-core pilot; feeder pillar, dividing boxes, switchboard instruments and stoneware troughing. See "Official Notices" to-day.

London.—Bermondsey.—Sept. 7th. B.C. 500-kw. rotary converter. See "Official Notices" August 3rd.

H.M. Office of Works.—August 20th. 400 miles of bell wire. See "Official Notices" August 10th.

Manchester.—August 18th. Supply, &c., of two electrically-driven turbo-pumps with automatic control and switchgears, &c., for the Waterworks Committee. The Secretary, Water Department, Town Hall.

Portsmouth.—August 28th. Tramways Committee. Six months' supply of engine-room stores, insulating material, &c. See "Official Notices" August 10th.

Rathmines.—August 29th. U.D.C. 500 tons of coal for the electricity works. Particulars from the Electricity Department.

CLOSED.

Heywood.—T.C. Supply of 300 tons of coal: Mr. John Chadwick.

Peterborough.—T.C. Coal for the electricity works: Fairweather & Son, £1 1s. 7d. per ton.

Sheffield.—The T.C. has accepted the tender of Dewhurst's Engineering Co., Ltd., for the supply and delivery of 500 steel boiler tubes, also the tender of the Stirling Boiler Co. for a similar quantity of boiler tubes. Items covering transformers of 2,500 and 5,000 K.V.A. capacity respectively are to be added to the schedule in the contract with the British Electric Transformer Co., Ltd., for the supply of transformers, accepted on August 1st, 1916.

NOTES.

Thoughtlessness in Power Plants.—The thoughtless man in the power plant is the type that opens the valve on the wrong boiler and traps a fellow employé inside in a cloud of sizzling steam, who blows down the boilers with the blow-off connection open to a dead boiler with men working inside, who unthinkingly closes the wrong switch or grabs hold of a live high-voltage circuit, or numerous other things that could be mentioned. He is thoughtless because he is so busy thinking about what he did yesterday or what he expects to do to-morrow, or puzzling his brains about problems foreign to his work, that he has no time to keep his mind on what he is doing, and as a result jeopardises the lives of his fellow workers and the equipment under his care.

Not long ago several painters were painting the ceiling and walls of a large power house. At this particular time they were working above the switchboard. To keep the board and wiring from being spattered with paint, they had draped a large piece of canvas over the board and busses. About this time a friend dropped in to visit the chief, who had also just come in. He gave one glance at the canvas over the switchboard, and then asked the chief what would happen if one of the circuit-breakers should open on a heavy short-circuit. The chief saw the point, and started to draw the switchboard operator's attention to the dangerous condition, when the thing happened.

The system was 600-volt direct-current, and the circuit-breakers were mounted at the top of the board. The old canvas, soaked with paint, oil, benzine, &c., was hung on the top of the board and draped down over the front, probably not being over two inches from the carbon contacts of the breakers. It seems only an instant after the breaker opened before the canvas was a mass of flames. The smoke and fumes blinded the men, who were working directly above, so they were unable to do anything to save themselves, and to add to the situation, one of them dropped a small iron bar, which went end first through the canvas and fell across the bus-bars. There was a flash and a roar as the circuit-breakers for the machines blew out and shut the whole system down. The men, terror-stricken, jumped to the floor. Two of them were seriously injured, one having both legs broken and another an arm broken in two places besides several ribs; the rest escaped with minor injuries. The switchboard operator had allowed the painters to cover up the board according to their own discretion, and had paid little or no attention to how they did it, because he was busy laying out a wiring diagram for a friend's garage.

The absent-minded man has no business in the modern power plant, and if he is unable to take enough interest in his work to keep his mind on what he is doing, he had better look for a less exacting vocation, where the results of his mistakes are not of much consequence.—E. W. Miller, in *Power*.

Electric Announcer at Dutch Auctions.—The Office of the United States Commercial Attaché at the Hague reports that at the regular trade auctions, held in the Netherlands, instead of having an auctioneer call for bids, there is a large dial, provided with an index hand. The face of the dial is marked with prices increasing in clockwise fashion. The hand is set at a price above that which the goods offered will probably bring, then is slowly moved to lower and lower figures until some trader indicates his willingness to buy. Electric push-buttons are connected with the dial, which the traders press when a price satisfactory to them is shown by the dial. As the trader presses his button his number appears on the face of the dial, and the lot of goods is sold to him at the price indicated by the index hand. There is no noise or confusion, and the auctions are finished in a remarkably short space of time.—*Journal of the R. S. A.*

Trade with Italy.—The following inquiries for agencies for United Kingdom firms from persons and firms in Italy, some of whom formerly represented German and Austrian firms, have been received at the British Chamber of Commerce for Italy, 7, Via Carlo Felice, Genoa. The inquirers are desirous of negotiating for agencies now, irrespective of whether United Kingdom firms are able to give deliveries at present. All communications regarding the inquiries should be sent to the Secretary of the Chamber, as above, quoting the reference numbers:—

An Italian firm at Bari wishes to represent manufacturers of motors, machinery, and tools for agricultural, electrical, and building purposes (1,401).

A firm of engineers at Genoa would represent firm manufacturing or exporting electrical materials, steel, tools, general machinery, and engineering goods; also chemicals (1,404).

An engineer, who is manager of a mining company, is prepared to take up the representation of manufacturers of industrial machinery in general, particularly for shipbuilding (1,406).

A Bologna agent (British subject) wishes to obtain agencies for manufacturers or merchants who are interested in trade with Italy (1,407).—*Board of Trade Journal.*

German Electrical Plant Failure at Sydney.—We read in the *Sydney Morning Herald* that on June 15th, at Sydney, the Lord Mayor gave an explanation regarding the use of German electric light machinery by the City Council. He said that the machinery, which was supplied under a German contract, was giving only 80 per cent. of the power anticipated. The City Council had retained a sum of between £4,000 and £5,000 owing to the fact that the machinery had not been successful. Immediately the order for the duplicate set was cancelled the Council took steps to make a contract with a British firm for supplying a set, and this machinery was now running. The Lord Mayor added:—"There is no machinery lying in bond or in any place in Australia of German origin, or of German manufacture, for which the City Council has paid, and has not taken delivery. Secondly, there is no machinery of German origin or manufacture, intended for the Sydney Council, in bond in Sydney or any other place in Australia for which the City Council has not paid; and thirdly, so far as is known, there is no machinery of German or any other origin or manufacture for disposal in Sydney, or in any other place in Australia, which could be used by the City Council in increasing its output."

According to the *Sydney Daily Telegraph*, it had been alleged that German machinery was available in bond, and might be obtained by the City Council with a view to increasing the output and retaining the services of the men who were recently discharged.

Ald. Meagher said that a contract was entered into in the year 1913 for a 5,000-KW. turbo-alternator to be made in Germany, the amount quoted being several thousand pounds less than any other tender, British or American, besides which the plant was the most economical in fuel. In the light of subsequent events it appeared, however, to have been a factor in the dumping process carried out by Germany, as, about the time named, contracts in Sydney, Melbourne, Shanghai, and South Africa were simply swamped by German machinery, tendered for at cut prices.

The turbo-alternator referred to was put to work in April, 1914. For a few weeks it was highly successful and extra economical in operation, and on the strength of the experience acquired a duplicate set was ordered from the same people. Some few weeks after ordering the duplicate set the original set broke down deplorably, incidentally causing the extinction of all the lights in the city.

The contractors were advised by cable, and arrangements made immediately for supplying replacement parts, which had not arrived when war was declared. On the declaration of war the order for the duplicate plant was immediately cancelled. Later on certain replacement parts arrived. Unfortunately, on opening up the machinery, some two or three weeks after, it was found that the moving parts were touching the fixed parts, and there was a narrow escape of another breakdown similar to the original one occurring. The result is, declares the Lord Mayor, this machinery is only giving 80 per cent. of the power anticipated.

Foreign Trade.—The July Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	July, 1917.	*Inc. or dec.*	*7 months*, 1917. *Inc. or dec.*
Imports.			
Electrical goods ...	99,968	— 28,010	— 139,782
Machinery	654,942	— 29,351	— 477,633
Exports.			
Electrical goods ...	246,932	—103,035	— 493,263
Machinery	1,913,086	+152,032	+ 1,006,570

Trade with Canada.—Mr. C. Hamilton Wickes, His Majesty's Trade Commissioner in the Dominion of Canada and Newfoundland, gives some hints to traders with that Dominion in the report dealing with the trade of Canada for 1916, just issued. He states that in the course of a recent visit to the Western Provinces he was impressed by the prevalent desire among business men for improved commercial relations with the United Kingdom, and for a larger trade in British goods. In appointing agents to represent them in Canada, he says, British firms should investigate thoroughly the standing and reliability of the persons whom they contemplate employing. The assistance of the Department of Commercial Intelligence of the Board of Trade may be invoked in this connection. The majority of Canadian importers in goods, handled directly or indirectly through the retailer, look for credit such as is customarily extended by the established American manufacturers. It is no use for British manufacturers of such goods to insist on "cash against documents," or "before shipment." British shippers should also make themselves familiar with Canadian Customs regulations and tariffs.—*Financial Times.*

Educational.—University of London—University College.—The new session for 1917-18 of the Faculty of Engineering commences on October 1st. In addition to the degree and diploma courses, special courses can be arranged, and post-graduate and research work is provided for. A Goldsmid entrance scholarship (£90) will be competed for in September. See our advertisement pages for particulars.

Industrial Reconstruction.—The Employers' Parliamentary Council has issued a memorandum on industrial reconstruction, in which it deals with the interim report on "Joint Standing Industrial Councils" presented to the Prime Minister by the Sub-Committee on "Relations between Employers and Employed" (reviewed in our issue of July 6th).

The memorandum states that the first point that prominently presents itself in the report is the assumption, or implication, that the Labour Unions represent the whole of the workpeople of the country, which is not the case. It may be true that in certain industries the Unions do, in a large measure, if not fully, represent the workpeople employed therein; but, taking the workpeople throughout the country, the overwhelming majority are not members of Labour Unions. Nationally speaking, therefore, the Unions represent only the minority, and can speak and act only in the name of that section of labour that is organised.

The report does not make note of the privileged position of Labour Unions under the Trade Disputes Act. The Employers' Parliamentary Council submits that freedom and security for industry are impossible until all combinations of capital and labour are subjected to the ordinary law of the land, and conspiracies for "paralysing the country" by means of general strikes and lock-outs are rigorously suppressed. The repeal of the Trade Disputes Act must be regarded as a condition precedent to the establishment of that close co-operation between employers and employed which has now become, more than ever, vitally essential to industrial prosperity.

The Sub-Committee submits proposals for "the formation of Joint Standing Industrial Councils in the several industries, where they do not already exist, composed of representatives of employers and employed," and gives examples of the questions with which the Councils should deal. The memorandum points out that it may be doubted whether any industry is completely and perfectly covered by organisations either of employers or employed; and whether it is possible or practicable to bring within the scheme those industries where no organisation exists, or where the organisation is imperfect. At present the Sub-Committee insists that "the Councils should be composed only of representatives of Trade Unions and Employers' Associations, and that new organisations should be admitted only with the approval of the particular side of the Council of which the organisation would form a part."

When confronted by the questions: "Is it intended that decisions reached by the Councils shall be binding upon the bodies composing them? If so, is such binding effect to be conditional upon the consent of each Employers' Association or Trade Union affected?" the Sub-Committee can only answer that agreements reached by the Councils will "carry with them the same obligation of observance as exists in the case of other agreements between Employers' Associations and Trade Unions." The significance of this will be appreciated by Employers' Associations which have had experience of the "binding character" of such agreements as those referred to. It is idle to suggest that the agreements reached by the Industrial Councils could be of any real or lasting consequence, or be considered as possessing any proper guarantee that their terms would be enforced, unless they were of a legal character with provision for penalties recoverable out of funds reserved to meet liabilities involved. The Sub-Committee suggests that "it may be desirable at some later stage for the State to give the sanction of law to agreements made by the Councils, but the initiative in this direction should come from the Councils." It is certain, says the memorandum, that this aspect of the question will arise immediately the Councils, if established, set to work; and it can be settled only in the practical way mentioned above.

As regards the restoration of Trade Union rules and customs suspended by the war, the Committee insists that "the definite co-operation and acquiescence by both employers and employed must be a condition of any setting aside of these guarantees or undertakings"; may it be assumed that "the lessons of the war" have convinced even the Labour Unionists responsible for the old and fatal policy that the rules and customs referred to can, in the very nature of things, never be restored? There are many indications that warrant this assumption; and if it can be made a matter of mutual agreement between Employers' Associations and the Labour Unions, the outlook for British industry will be full of hope and promise. If not — well, says the memorandum, the writing is on the wall, and there can be no mistaking its direful meaning.

Taking the report under review as a whole, the Employers' Parliamentary Council expresses its appreciation of the efforts made by the Sub-Committee to propound a solution of the problem by which the country will soon be faced. While many of the recommendations are, in the opinion of the Council, in themselves laudable, and to some extent practicable—as a matter of fact certain of the recommendations are already, and have for long been, in operation in several industries—others are of a nebulous character, suitable more for academic discussion than for practical experiment. The report will, however, serve the useful purpose of presenting the problem of industrial reconstruction on definite lines; and in this respect, says the Council, the recommendations of the Sub-Committee should be studied and digested by those concerned, with a view to a true and lasting solution being found.

Japan's Progress in the Electrical Industry.—Referring to his article in our last issue on Japan's progress in the electrical industry, Mr. Malcolm Chalmers points out that the Japanese returns for May, which have just come to hand, confirm his remarks as to this year's exports, particularly in the case of electric lamps. The exports of these lamps in the month of May numbered 702,107, valued at about £13,000, bringing the total for the year to date up to nearly 5 million lamps, valued at £97,000.

Fatalities.—An inquest was held on August 10th, at the Hemsworth Workhouse, on the body of Walter Hodge, aged 55, who was killed whilst at work at the Hodroyd Colliery, Brierley, on August 8th. He went to work, as usual, in the sub-station, through which run live wires conveying current at 10,000 volts from the Yorkshire Power Co.'s system to the colliery works, and about 20 minutes later he was found by the electrician, Charles Lewis, lying dead under the landing, the ironwork of which he had started to paint.—*Leeds Mercury.*

Eric Grayson, a St. Helens boy, aged 10 years, was last week killed by shock in the glass bottle works of Messrs. Cannington and Shaw, St. Helens; it was stated at the inquest that he had no right in the works. Verdict: Death from misadventure.

A verdict of "Accidental death" was returned at the adjourned inquest on Samuel Cowsill (23), electrical wireman, of Lower Broughton, who died as the result of burns sustained whilst at work, as mentioned in our last issue.

At an inquest at Wallsend on two boys, 8 and 6 years of age, it was stated that the boys were found with their heads against a live rail, in which position they had been lying all night. A verdict to the effect that the boys were killed by shock while trespassing on the railway was returned.

Forth and Clyde Ship Canal.—In the *Times Trade Supplement* for August, the proposal of the Government to proceed with a scheme for constructing a ship canal between the Forth and the Clyde is discussed. It is stated that the distance by the most direct route would be 30 miles, and no locks would be needed except the sea-gates at each end. The purposes to be served by the proposed canal would be primarily of a strategic rather than commercial nature, the bottom width being 148 ft. and the depth 40 ft.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. A. Ullmann.
Next for Duty.—Platoon-Commander C. Campbell.
Monday, August 20th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.
Tuesday, August 21st.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.
Wednesday, August 22nd.—Drill and elementary bridge construction for No. 1 Company, Left Half Company.
Thursday, August 23rd.—Drill and elementary bridge construction for No. 2 Company, Left Half Company. Ambulance Class.
Friday, August 24th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Signalling Class. Recruits' Drill, 6.30.
Saturday, August 25th.—Commandant's Parade for Route March and Drill. Parade Putney Bridge Station, 2.45 p.m. Uniform.

(By order) MACLEOD YEARSLEY.

Electroculture.—Messrs. Harry W. Cox & Co., Ltd., of 159, Great Portland Street, W., have recently reprinted, in pamphlet form, the article on H.T. discharge apparatus and its application to electrocultural operations, which appeared in our issue of July 6th last. The pamphlet contains many useful hints to those who are studying this subject, and can be obtained by applying to Messrs. Cox.

Appointments Vacant.—Engineering staff for ordnance depôts, aerodromes, and military camps in the Southern Command; armature winder for the Keighley Electricity Department; shift engineer (50s.), shift driver (35s.) for the R.E., Wylde Valley district. See our advertisement pages to-day.

South African Institution of Engineers.—The following gentlemen have been elected officers for the ensuing year, the election of president being unavoidably deferred:—Vice-presidents, Messrs. E. G. Izod and C. D. Leslie; hon. treasurer, Mr. Edward Goffe.—*South African Mining Journal.*

New Insulation Material.—According to the *National Tidende* (Copenhagen) of July 21st, a Danish chemist has invented a process by which fish offal may be made to yield not only oil, but also a solid substance named "Corimite," which is specially suitable for electrical insulation. A company, capitalised at 70,000 kroner, has been formed to work the process, and production is expected to begin during the present year.—*Board of Trade Journal.*

Electricity for Cooking.—A Manchester correspondent writes that a Special Sub-Committee of the Engineers' Club, Albert Square, Manchester, having gone into the question whether gas or electricity should be installed for cooking purposes in the club kitchen, has recommended the adoption of electricity, and that a range, made by the Carron Co., will shortly be placed in position. It is stated that before deciding upon electric cooking the Sub-Committee inspected a similar apparatus in the works' kitchen at Messrs. Haworth's cotton mill, Salford, where the results are reported to be completely satisfactory, both as regards cost and quality of the cooking.

Dilution of Labour.—In the House of Commons, on Wednesday, in Committee on the Munitions of War Bill, Mr. Churchill announced that the scheme for the dilution of labour in private works must be dropped, in order to enable the Bill to pass before the adjournment. The leaving certificate would be abolished, subject to certain safeguards, including the requirement of a week's notice, and provision to prevent men from leaving munitions for private work. The amendments were welcomed generally, and new clauses having been agreed to, the Bill was read a third time.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—On the recommendation of the Public Works and Tramways Committee, the Burton T.C. has approved of an increase of £25 a year in the salary of the tramway manager, Mr. A. B. SLATER.

The Portsmouth Tramways Committee recommends that the salary of Mr. W. R. SPAVEN, general manager, be increased from £500 a year to £550 forthwith, and to £600 in a year's time; and that the salary of Mr. V. G. LIMONI, the resident engineer, be increased from £400 to £450 now, and to £500 in a year's time.

The Hereford Electricity Committee has recommended the payment of 100 guineas as an honorarium to Mr. KERR, city electrical engineer, for the additional work he has had thrown upon him in consequence of extensions to the generating plant, &c., which have been carried out under his supervision. The Committee also recommends that the salary of Mr. G. H. WATSON, assistant electrical engineer, be increased from £156 to £208 a year.

At the annual meeting of the South African Institution of Engineers, Lieut.-Colonel DOBSON, D.S.O., was presented with the Institution's gold medal for the 1915-16 session.

Mr. F. BAILEY, of Bolton, has been appointed assistant station superintendent at Salford at a commencing salary of £200 per annum.

Mr. A. BOOTHROYD, of Huddersfield, has been appointed manager of the Holmfirth District Council's electricity undertaking.

Referring to the note in our issue of August 3rd with regard to an award for improvements in soldering irons, we are informed by Mr. J. WILKINSON, tramways electrical engineer, that the inventor was not, as stated, a member of the Hull tramway staff.

The Stockport T.C. has granted £200 to the electrical engineer for services rendered in connection with the extensions to the electricity works.

Mr. E. JORDAN, of the South Lancashire Tramways Co., was on Wednesday last presented by the engine-room staff with a wristlet watch, on the occasion of his leaving the company to join H.M. Forces. Mr. E. H. Edwardes, the general manager, made the presentation.

General.—Mr. C. CLARE ATCHISON, who was until recently the manager of the Rochdale Corporation electricity works, retiring owing to ill-health, is now engaged on war work at Bristol, being Dilution Officer there.

The marriage took place at Blackburn last week of Captain GORDON DOUGLAS COE, R.G.A., only son of the Rev. Gordon Coe., Vicar of St. Matthew's, who performed the ceremony, and Miss Lilian Harwood McAdam. Captain Coe was employed at the Blackburn Corporation electricity works at the outbreak of war.

Roll of Honour.—The death at sea is reported of Mechanical Staff-Sergeant ALFRED HENRY MARSHALL, of the Mechanical Transport Section of the A.S.C. He was 29 years of age and a native of Scarborough, but was well known as an electrical engineer and motor engineer in York and Newcastle, where, though not in business on his own account, he had charge of the working staffs of large undertakings. Whilst in charge of a workshop overseas, and a member of the motor ambulance, he invented and constructed a single-wheel stretcher carrier for use in the narrow trenches. The conveyance was adopted by the military authorities. He was invalided home in April, 1916, and again in January of this year, and after a period as supervisor of a workshop he sailed for the Eastern front in April.

Private F. CLOUGHTON, Essex Regiment, who has died of wounds received in action, was with Messrs. Siemens.

Private L. HARDING, King's Liverpool Regiment, one of three soldier brothers, has been killed in action in France. He joined the Army on the outbreak of war, and before enlisting was employed by Messrs. Siemens Bros. Dynamo Works, Ltd.

Company-Sergeant-Major J. MEARY, East Lancs. Regiment, who was with the Salford Corporation tramways, has been awarded the D.C.M. and the Military Medal. At the Town Hall, last Friday, the Mayor, in pinning the medals on the sergeant-major's breast, remarked that it was the first occasion that he had had the honour of attaching a dual award to a Salford soldier.

Lance-Corporal W. HOLLIDAY, Manchester Regiment, killed by a shell, was formerly employed by the British Westinghouse Co., Ltd.

Bombardier B. CLARKE, R.F.A., killed in action, was an electrical engineer with the Carbonic Gas Co., Manchester.

Private R. AMBROSE, King's Liverpool Regiment, died of wounds, was employed by Messrs. I. Frankenburg & Sons, Ltd., cable manufacturers.

Sapper J. SUTTON, R.E. (Signallers) is in hospital from the effects of gas poisoning. He was electrician to the Derwent Valley Water Board, Bamford.

Gunner G. WILSON, R.G.A., a former Burnley tramcar driver, has been mortally injured in France.

Private W. CLARE, West Yorkshire Regiment, killed in action, was formerly on the staff of the Halifax Corporation tramways.

Private E. NORBURY, Northumberland Fusiliers, who has fallen in action, was on the staff of the Manchester Corporation tramways.

Lieutenant W. A. BOISSIER, Royal Marine Artillery, formerly in the Derby Corporation electricity department, has fallen in action. He was a son of the Rev. F. S. Boissier, Vicar of Denby, and enlisted whilst in business for himself as an electrical engineer.

Private H. S. FITCHETT, Northants Regiment, reported missing since the battle for the Dunes in Belgium, was formerly on the staff of the Northampton Tramway Co.

Sergeant G. ADAMS, R.F.A., who was prior to the war engaged at the Rugby works of the B.T.H. Co., has been awarded the D.C.M. for bravery in action in Mesopotamia.

Signaller J. B. SPENCER, Royal Warwickshire Regiment, killed in action, joined the regiment last September from the staff of the B.T.H. Co. at Rugby, where he acted as Assistant Scoutmaster.

Bombardier A. GOODE, Rugby Howitzer Battery, who enlisted whilst an engineer with Messrs. Willans & Robinson, of Rugby, has been severely wounded in France.

Major R. C. MATHER, son of Mr. Colin Mather, Wrenwood, Hilton Lane, Prestwich, Manchester, is in hospital for the second time, suffering from shell-shock. He was previously wounded in August last year. Major Mather is connected with the well-known engineering firm of Mather & Platt, Ltd., Park Works, Manchester.

Private T. EVANS, K.O.Y.L.I., who was an employé of the Yorkshire (W.D.) Electric Tramways Co., is reported to have died from gas poisoning.

Private A. MARTIN, who was employed in the Glasgow tramways department, has been killed in action.

Lance-Corporal J. SANDS, Border Regiment, killed by a sniper whilst on patrol duty, was before enlistment employed by Messrs. Charles Macintosh & Co., Ltd., electric wire and cable makers, Manchester.

Lance-Corporal T. WALLWORK, Loyal North Lancashire Regiment, who has died of wounds, had been previously awarded the Military Medal for conspicuous bravery. Prior to enlisting he was employed by Messrs. Eckstein, Heap and Co., Ltd., electrical engineers and manufacturers, Manchester.

Will.—According to the *Times*, the late Mr. JOHN HENRY TUCKER, electrical fittings manufacturer, Birmingham, left £290,760, of which £161,552 was net personalty.

NEW COMPANIES REGISTERED.

Harris Plating Works, Ltd. (148,189).—Private company. Registered August 10th. Capital, £8,000 in £1 shares. To take over the business of electro-platers and polishers carried on at 222-8, Goswell Road, and 2, President Street, London, as the Harris Plating Works, also to carry on business of tube makers, japanners, enamellers, electricians, &c. The subscribers (each with one share) are: E. W. Harris, 224, Goswell Road, E.C., electro-plater; J. A. Watts, 75, Billiter Buildings, E.C., engineer. Permanent directors: E. W. Harris and J. A. Watts (chairman). Registered office: 2, President Street, Goswell Road, E.C.

High-Speed Machinery Co., Ltd. (148,199).—Private company. Registered August 10th. Capital, £2,500 in £1 shares. Mechanical, electrical, sanitary, hydraulic, motor, gas, water, telegraph, and telephone engineers, machinists, &c. The subscribers (each with one share) are: J. P. Annacker, Springfields, Powys Lane, Palmer's Green, N., engineer; F. B. Spear, Hazlewood, Fairview Road, Sutton, sales manager; B. Strachan, Fairport, Hillcroome Road, Sutton, merchant. The first directors are: Joseph P. Annacker, Karl Johann Almfelt, Francis B. Spear, Balfour Strachan, and Howard W. Whitworth (all permanent subject to holding 250 shares each). Solicitors: Chamberlayne, Hacking & Co., 45, Parliament Street, S.W.

Marconi International Code Co., Ltd. (148,204).—Private company. Registered August 10th. Capital, £5,000 in £1 shares. To take over from the Wireless Press, Ltd., all inventions, patents, and rights acquired by that company, or to which that company is entitled, under various agreements recited in an agreement between this company and the Wireless Press, Ltd., to compile, print, publish, and deal in codes, newspapers, magazines, and books, &c. The subscribers (each with one share) are: W. W. Bradfield, Marconi House, Strand, W.C., electrical engineer; H. W. Allen, 51, Braxted Park, Streatham Common, S.W., chartered secretary. The first directors are: Godfrey C. Isaacs, Captain H. Riall Sankey, Chas. V. Daly, Wm. W. Bradfield, and Hy. W. Allen. Qualification, one share. Remuneration, as fixed by the company. Registered office: Marconi House, Strand, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Enterprise Manufacturing Co., Ltd.—Mortgage debenture dated August 3rd, 1917, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. P. Grange, Latchford, Warrington.

White, Jacoby & Co., Ltd.—Particulars of £1,500 debenture created March 29th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £630. Property charged: The company's real and personal property, including uncalled capital.

Europe & Azores Telegraph Co., Ltd. (39,452).—Capital £900,000 in £10 shares. Return dated July 18th, 1917. All shares taken up. £55,680 paid; £144,320 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd.

The report of the directors for the year 1916 states that the gross receipts for the year amounted to £31,703, against £33,526 for the previous year, whilst the net profits earned, before charging depreciation, were £4,121, against £7,205. There had been a considerable amount of labour agitation in Kalgoorlie during the year and several strikes had taken place. The decrease of £1,823 was largely accounted for by the falling-off in the workmen's traffic to and from the mines. The company's agreement with its employés under the arbitration award given in 1913 expired during the year. In July the Tramways Employés' Association presented a new log of wages and working conditions which the company could not see its way to accept. The matter was referred to the Arbitration Court. During the year the cars travelled 581,085 car miles, as against 593,434 car miles in the year 1915, and carried 2,052,685 passengers, as against 2,192,135 in the year 1915. The earnings per car mile in 1916 were 12.98d., as against 13.52d. in 1915, with an expense of 10.27d. per car mile, as against 9.93d. in 1915. The expenses per cent. of earnings in 1916 were 79.14 per cent., as against 73.44 per cent. in 1915. The number of units consumed in 1916 was 680,785 (£7,801), as against 692,935 (£7,940) for the year 1915. The "A" debenture stock had been further reduced by the sum of £700 during the year under review, and the amount of stock outstanding at the date of the accounts was £47,300.

At the meeting on August 9th Mr. Oliver Wethered presided, and stated that the period had been one of difficulty and anxiety; the mines—on which the prosperity of Kalgoorlie necessarily depended—were passing through a very trying time. In 1916 there were 1,331 less men employed on the mines than the year before, and this meant a loss of about £4,000 a week in wages alone throughout the district. There were 1,124 less men employed in 1915 than in 1914. As in most other labour centres, the men at Kalgoorlie were demanding higher wages and improved conditions of working, with threats of strikes if their demands were not acceded to. The Judge of the Federal Arbitration Court had stated that a company's falling revenue, or its financial position, would not be taken into consideration by him when arriving at what he considered a fair rate of wages to be paid to its employés. Unlike other businesses, it was not possible for them to call on the public to share part of the extra expenses put upon the company, and, although the cost of every article used in the running and upkeep of the tramway might be doubled or trebled, the fares must remain the same, and the cars must run according to schedule. The Transcontinental Railway had been delayed in construction owing to the shortage of freight and the difficulty of obtaining rails; but the latest information from the office of the Commonwealth Government was that it would be completed next month (September). Its completion might favourably affect the situation, but some good discovery of gold in the district would do far more. Meanwhile they were doing their best to reduce costs to the lowest figure through their loyal and capable representatives. The report and accounts were adopted unanimously.—*Financial News.*

Marconi's Wireless Telegraph Co., Ltd.

Mr. Godfrey Isaacs presided at the meeting of this company on August 9th, in the absence of Senatore Marconi. He said that capital account had undergone no change during the year. The general reserve, with the additional amount which was being placed to the credit of this account, was now represented by the round sum of one million pounds sterling; it had been built up entirely within the last five years. The cash at bankers and in hand at the end of the year showed a very substantial reduction, which was accounted for largely by the great increase of sundry debtors, debit balances, and expenditure on foreign developments which arose from the normal conditions of their business. The investments showed little change. The company had that day invested in 5 per cent. war loan the sum of £200,000. The shares in associated companies and patents showed a small increase both in the balance sheet and in their par value. The latter figure was now represented by £2,487,450. Turning to the profit and loss account, the balance of contracts, sales, and trading account was less than that of the preceding year, as likewise was the balance of the net profit, but it must be borne in mind that during the year 1915 they had some large contracts of an exceptional nature to carry out. Last year they had done considerable business with the Admiralty, and nothing could have been more agreeable than the relations between the company and that department; the high officials with whom they had had to deal at the Admiralty had told him how deeply they were indebted to the company for its consistently admirable and prompt work on their behalf. The relationship between the Admiralty and the company had continued to be equally agreeable to the company, and he had every reason to believe it had been at least equally satisfactory to the Admiralty. The Marconi International Marine Communication Co., Ltd., had shown a very substantial development, and its progress this year was even greater than it was last. They regarded that business as a very sound industrial investment which was not likely to return less than 15 per cent. per annum, and they had every reason to hope to see an improvement even upon that. These very satisfactory results were due simply to increased volume of business, and not to increased charges. The Russian company had continued to do a very large business, and had paid a dividend for 1916 at the rate of 17 per cent., but ever since the outbreak of war the rate of exchange had been very much against this country, and it had, therefore, been quite impossible to bring home very large sums of money which had been accumulated in Russian roubles unless they were prepared to face a very substantial loss. They had, however, written off from their profit and loss account whatever sum was represented by loss at the end of each year, as though they had brought their money home. The rate of interest on money ruling in Russia had been very low indeed; the opportunities for development of manufacturing businesses were never better. They therefore adopted a policy of investing their money in other factories closely allied with their own business. These businesses were being conducted largely by those who were responsible for the very able and successful management of their Russian company, and were proving very profitable investments. They would have no difficulty in realising upon very advantageous terms if they wished to do so. Their view, however, was that factories in Russia would have even better prospects after the war, and there was, therefore, every advantage in continuing to leave their money where it was for the present. The French company had declared an increased dividend for the past year both on the ordinary shares and upon the founders' shares, and continued to do a very satisfactory and progressive business. The Compagnie Universelle de Telegraphie et de Telephonie sans Fil, the shares of which were acquired by this company in furtherance of its programme prior to the war, was about to be transformed. The American company showed improvement in 1916, but, of course, continued to be handicapped very seriously in consequence of their Transatlantic stations being unable to work owing to the stations on this side being required for war purposes. The principal revenue of the American company was expected from its Transatlantic service, and very considerable expenditure was made upon the stations for that purpose. The whole of this money had been idle since the outbreak of war. The consequence was that, instead of very substantial revenue being obtained from this source, a yearly loss had resulted. Owing to the United States entering the war the Transatlantic stations and all the other American stations had passed temporarily into the hands of the American Government. Fair compensation would be paid, and negotiations were being actively carried on with a view to settling the terms. The same applied to the Transpacific service, which had been started and which was being successfully conducted. The immense number of orders which had been placed with the company by the United States Government should result in a very satisfactory year's work indeed, notwithstanding the closing of their telegraph services. The company had been very much occupied for some time past in the conduct of legal proceedings against infringers of their patents, and the results had been highly satisfactory. The most recent action was one in respect of the De Forest Valve Patents, which the Court held to be a complete infringement of the Fleming Patent, which was the property of the company. The Canadian company had had to contend with the abnormal conditions created by the war. However, their accounts would show an improvement over the preceding year. The Compania Nacional de Telegrafia sin Hilos, of Madrid, in which the Spanish and General Wireless Trust Co. were so largely interested, was making much more satisfactory progress. The Belgian company's business continued to develop very satisfactorily, but as they were unable to have any communication with their head office, it was impossible for them finally to close their accounts. Referring to the Locker-Lampson case and a circular which had been forwarded to the shareholders, he said that at every annual meeting subsequent to 1912 he had been prevented from saying anything about the business which Mr. Marconi and he carried out in America, inasmuch as the action had been commenced and the matter was *sub judice*. This was the first year that he had been free to speak. A circular of an extremely damaging nature had been sent to 12,000 shareholders in all parts of the world. That circular must be answered. Mr. Isaacs proceeded to recount the circumstances in which, in order to carry through the reconstruction of the American company, at the request of Mr. Marconi he made himself personally responsible for £500,000 of new capital, while the English company guaranteed the remainder of the £1,400,000 required. He detailed the subsequent history of the dealings in the shares, the excitement in the market owing to the loss of the *Titanic*, which created a great demand for American Marconi shares, the outbreak of war, which prevented the inauguration of the Transatlantic service when it was on the point of starting, the inquiry into the company's contract with the Postmaster-General for a chain of Imperial wireless stations, and the litigation, lasting three and a half years, which was brought against the directors and others, and eventually withdrawn. The circular issued by Mr. J. W. Hamilton was fully dealt with, Mr. Isaacs declaring that he had never received one penny profit from the transactions that were criticised, and that the company had never gone into the market to offer shares in any of its

subsidiary companies. He also read a letter from Mr. Marconi stating that it was impossible to over-value the services which Mr. Isaacs had rendered to the company, and that if the shareholders, contrary to his expectations, supported the threatened renewal of personal attacks upon him (Mr. Isaacs) and the other directors, he would terminate his connection with the company by resigning from the board. Neither Mr. Marconi nor he could tolerate this sort of persecution for ever, and he would ask them, therefore, to pass a resolution expressing their complete confidence in the chairman and managing director and the board, and with the way in which they had conducted the affairs of the company in the past and were conducting them to-day. The Transatlantic service had been closed down, in no sense on account of any fault on the part of anybody or any complaint of any kind whatsoever, but solely because the exigencies of war to-day had demanded it. The company would, of course, be entitled to full compensation from the Government. Since the issue of the report and accounts negotiations had been opened with a view to settling two important items under the four heads of claims upon the Government: (1) for remuneration and compensation in respect of the use of the company's high power stations since the beginning of the war, the staffing and management of those stations, and other services in connection therewith; (2) their claim in respect of the withdrawal of the Post Office from the contract for the Imperial chain of stations. Notwithstanding all their efforts, they were not able until the previous night to get anything in the nature of a definite suggestion out of the Post Office. As regarded the Imperial contract, there had been many negotiations, and on several occasions they had, by request, postponed any public move in the Courts with a view to further negotiations for a settlement. Negotiations, however, were now proceeding afresh, and they appeared to be nearer to a settlement than ever before. Should they again be disappointed, they had determined at a very early date to convene an extraordinary general meeting. With regard to the claim upon the War Office, this dealt with a question of patent rights, and having regard to the immense work which the War Office had to perform in these times, it would not be fair to complain of that department finding itself unable to deal with their claim until after the war. With regard to the Admiralty, they had been given the assurance that everything possible had been done and would be done to expedite the matter. He felt sure that all those shareholders who had been interested in the company for many years would warmly approve the appointment of Mr. Allen and Mr. Bradfield to the board. He moved the following resolution:—"That the report of the directors submitted, together with the annexed statement of the company's accounts at December 31st, 1916, duly audited, be received, approved, and adopted."

Mr. Henry S. Saunders seconded the resolution, and said that the work done by Mr. Godfrey Isaacs in America had received the full support of the directors, who had congratulated him on the wonderful service which he rendered to the company when he was over there.

Mr. J. W. Hamilton, who said he represented by proxy over 300 shareholders, then addressed the meeting amid considerable interruption. He moved an amendment to the effect that the adoption of the report be postponed, and that the meeting be adjourned in order to allow a committee of investigation to be appointed, with authority to inquire into the charges which had been made in the Locker-Lampson action, and into the conduct of the company's affairs.

The amendment, however, was not seconded, and the report and accounts were unanimously adopted.

Mr. Reginald Woodward moved a resolution expressing the complete confidence of the shareholders in the chairman, the managing director, and the board, and the manner in which they had conducted the affairs of the company in the past and were conducting them at the present time.

This was seconded by Mr. Horace Boot, and a shareholder having suggested as an addendum "that the greetings of the shareholders present be sent to Mr. Marconi," the proposition, with this addition, was carried with acclamation.

The Chairman next moved the declaration of final dividends of 5 per cent. on the cumulative participating preference shares and 10 per cent. on the ordinary shares.

Mr. Samuel Geoghegan seconded the motion, which was unanimously agreed to.

The retiring directors and auditors were re-elected.

An extraordinary general meeting was then held, at which the Chairman proposed the following resolution:—"That the articles of association of the company be altered as follows:—By substituting the following article for article 77, that is to say—77. The remuneration of the directors shall, as from January 1st, 1917, be at the rate of £4,000 per annum, and in addition thereto in any year in which the dividend or dividends and/or bonus declared and paid for such year on the ordinary shares of the company shall be in excess of £7 per cent. on the nominal value of such shares, the remuneration of the directors shall be increased by the sum of £200 in respect of each 1 per cent. paid by way of dividend and/or bonus on the ordinary shares in excess of £7 per cent. as aforesaid. The remuneration of the directors shall be divided between the directors in such proportions as they may from time to time determine."

Captain H. Riall Sankey seconded the resolution, which was passed unanimously, and a vote of thanks to the chairman closed the proceedings.—*Financial Times.*

Oldham, Ashton & Hyde Electric Tramway.—Interim dividend of 5 per cent. per annum (6d. per share) on the ordinary shares, as last year.

W. T. Henley's Telegraph Works Co., Ltd.—Interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, for the half-year ending June 30th.

San Luis (Mexico) Tramways Co.—The accounts for the year ended March 31st show that, after providing for loan interest, &c., the debit balance of £10,137 brought forward was increased to £14,544.—*Financial Times.*

South Metropolitan Electric Light & Power Co., Ltd.—The transfer register and register of members of this company will be closed from August 18th to the 31st, 1917 (both days inclusive), for the preparation of warrants for dividends payable 31st inst., for the half-year ended June 30th, 1917, on the 7 per cent. cumulative first preference shares and the 6 per cent. cumulative second preference shares.

Lancashire Dynamo & Motor Co., Ltd.—Dividend of 2½ per cent., free of tax, making 12½ per cent. for the year, on the ordinary shares. The same rate was paid for 1915.

Brompton & Kensington Electricity Supply Co., Ltd.—Interim dividend for the half-year to June 30th on the ordinary shares at the rate of 8 per cent. per annum (less tax), the same as a year ago.—*Financial Times.*

STOCKS AND SHARES.

Tuesday Evening.

Material improvement has taken place in securities of the Mexican industrial companies. This is the main feature of the week in the foreign groups. Upon what ground it is based there seems to be some doubt felt in the Stock Exchange. The news from the country, most of it emanating from United States sources, is certainly less unfavourable; but it is only in this negative sense that the improvement can be expressed, so far as definite intelligence is available.

However, the bonds of the Mexico Tramways and of the Mexican Light and Power Companies have both risen several points. The shares have participated, and such offshoots as Pachuca 5 per cent. bonds are better at 27½, while Monterey 5 per cent. debenture stock is changing hands fairly freely on the higher basis of 20½. The strength is shared by Mexican Government, railway, and oil issues, from which it would appear that there is something more in the buying than the news warrants; and further information is awaited with keen curiosity.

Brazilians have been moving on a different plane, and Brazil Tractions eased off to 49, although Rio Tramway bonds hold their prices steadily. Rio Firsts are 87, and the Seconds 77½. San Paulo Firsts have been done lately at 89, while the 5 per cent. consolidated debenture stock last changed hands at 76. In the 5 per cent. debentures of the Southern Electric Tramways of Buenos Aires, bargains were marked early this month at 95 and a little over.

Victoria Falls & Power ordinary shares are unusually active, considering the time of year, at 19s. 6d.; and the preference have risen to 23s. 6d. Those happy folk who bought the ordinary shares at a few shillings each are in the fortunate dilemma of not knowing whether to take their profit or not. The shares look a very possible 10 per cent. investment, but, on the other hand, the profit is alluring. The preference do not seem to be over-valued, and there has been a little buying of the 5½ per cent. second mortgage debentures because of their receipt of interest tax free, although it must be remembered that the issue is repayable at 103.

The Marconi meeting had a stimulating effect upon the price of the shares, and from 2⅞ the price rose briskly to 3½, this including the recently-declared dividend. The preference are a little better at 2½, but it cannot be concealed that there is a certain amount of disappointment at the Government award being still left in the air. The cable market as a whole is good. Eastern ordinary at 144½ is a point up; so are Indo-Europeans at 53½. Chinas rose to 14½. Anglo-American preferred at 98 is a shade harder. The only change in the telephone share list is a rise of ½ in Orientals to 2½. Telephone of Egypt debenture is up a point to 78.

The railway market is doing little more than mark time. No changes have occurred amongst the electrical stocks. Central London guaranteed assented preferred ordinary has been bought at 60¾ since we last wrote. The assented deferred stands at 60½, while the non-assented is about 30. The assented ordinary stock, quoted in our price lists, is 61½, the non-assented 41½. A small amount of East London stock changed hands the other day between 3½ and 3¾, and London Electric Railway £10 shares were offered and declined to £2

per share. The company's 4 per cent. debenture stock marked 69 early this week, the return at this price being £5 16s. per cent. on the money, which is a decidedly better yield than is offered by the debenture stocks of most other Home Railway companies. Underground Income bonds strengthened to 82.

Electricity supply shares are quietly firm. Westminsters have risen to 6, pursuing their steady improvement; and City of London ordinary have gained ½ at 12¾. Charing Cross hold their rise at 3⅜; and Metropolitans advanced to 2¼. Amongst the manufacturing shares, British Insulated at 30s. 7½d. are 1/32 up. British Westinghouse preference put on 2s. 6d., the debenture gained 2 at 67½. Edison Swan 4 per cent. debenture is a point to the good, and India-Rubber shares jumped 7s. 6d. to 13½ for the reason that the shares pay very handsomely, apart altogether from the fact that the dividends are distributed at present free of income-tax.

A correspondent writes to ask whether we consider advisable the sale of Chelsea Electric and an exchange purchase of Marconi shares. This is one of the conundrums which can only be answered by the statement that Chelseas are investment shares, while in Marconis there lie very considerable elements of speculation. Relatively, Marconis are much higher, because they are £1 shares standing at 3½, whereas Chelseas, which are £5 shares, are about 2¾. Chelseas before the war were 4¼, while Marconis stood at 1 15/16.

The rubber market shows a good deal of strength, and this week the shares of nearly 40 different companies are marked ex dividend. The price of the raw material is steady at half-a-crown per lb. Iron and steel descriptions advance where they move at all; and in the base-metal section there is slightly more animation amongst tin shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Aug. 14, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6½	—	£5 18 6
Charing Cross Ordinary	5	5	3⅜	—	6 13 4
do. do. do. 4½ Pref.	4½	4½	3⅜	—	6 13 4
Chelsea	4	3	2¼	—	5 4 4
City of London	8	8	12¾	+ ½	6 4 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11¼	—	6 4 5
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	10	5½	—	6 11 7
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3⅜	—	5 6 8
Metropolitan	3	3	2¼	+ ¼	5 9 1
do. 4½ per cent. Pref.	4½	4½	3¼	—	7 4 0
St. James' and Pall Mall	3	3	2¼	—	5 18 6
South London	5	5	3¼	—	7 5 6
South Metropolitan Pref.	7	7	21/6	—	6 10 3
Westminster Ordinary	7	7	6	+ ¼	5 16 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	9⅜	+ ¼	6 2 5
do. Def.	2⅜	1½	22½	—	6 16 4
Chile Telephone	2	2	7	—	5 14 4
Cuba Sub. Ord.	5	5	8½	—	6 17 8
Eastern Extension	8	8	14½	+ ½	*5 10 4
Eastern Tel. Ord.	9	8	144½	+1	*5 10 9
Globe Tel. and T. Ord.	7	7	12⅜	—	*5 9 10
do. Pref.	6	6	10⅜	—	5 15 8
Great Northern Tel.	23	24	96	—	6 13 4
Indo-European	13	13	53½	+1	6 1 6
Marconi	10	15	3¾	+ 1/16	4 15 10
Oriental Telephone Ord.	19	19	2¼	+ ⅛	8 12 9
United R. Plate Tel.	8	8	8⅜	—	*6 0 9
West India and Pan.	6d.	6d.	1/16	—	1 12 0
Western Telegraph	8	8	14½	—	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	61½	—	6 10 1
Metropolitan	1	1	23¾	—	4 8 6
do. District	Nil	Nil	15⅛	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A"	Nil	Nil	5/8	—	Nil
do. do. Income	6	4	82	+ ½	*4 17 7
Foreign Trams, &c.	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5¾	5¾	9⅞	—	9 11 4
do. 2nd Pref.	5¾	—	2⅜	—	—
do. 5 Deb.	5	5	67	−1	7 9 3
Brazil Tractions	4	4	49	−1	—
Bombay Electric Pref.	6	6	10	—	6 0 0
British Columbia Elec. Ry. Prfce.	5	5	47½	−3	10 10 6
do. do. Preferred	Nil	Nil	31	+ ½	Nil
do. do. Deferred	Nil	Nil	30	+2½	Nil
do. do. Deb.	4½	4½	55	—	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	46½	+4½	Nil
do. 6 per cent. Bonds	Nil	Nil	52½	+3½	Nil
Mexican Light Common	Nil	Nil	15½	+1	Nil
do. Pref.	Nil	Nil	25½	+3	Nil
do. 1st Bonds	Nil	Nil	41	+1½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	+ ⅛	4 15 10
British Aluminium Ord.	7	10	30 7/8	−7/16	6 10 7
British Insulated Ord.	17½	20	132	—	7 15 0
British Westinghouse Pref.	7½	7½	2¼	+ ⅛	6 11 6
Callenders	20	20	14¼	—	7 0 6
do. 5 Pref.	5	5	4	—	6 1 8
Castner-Kellner	22	22	3⅜	—	6 10 2
Edison Swan, fully paid	—	—	1⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	71½	+1	5 12 0
Electric Construction	7½	7½	2⅜	—	6 0 0
Gen. Elec. Pref.	6	6	19½	—	5 17 1
do. Ord.	10	10	16	—	6 5 0
Henley	25	25	15	—	7 16 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	12⅜	+ ½	*7 6 10
Telegraph Con.	20	20	38½	—	*5 3 9

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 15th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£64	..
a Bisulphide of Carbon	"	£38	..
a Borax	"	£38	..
a Copper Sulphate	"	£61	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£11	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	"	£35	..
a " Lump	"	£35	..
a Soda, Chlorate	per lb.	10½d.	..
a " Crystals	per ton	12½/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/7½ to 1/8½	..
g " Bars (best selected)	per ton	£160	..
g " Sheet	"	£160	..
g " Rod	"	£160	..
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£162	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/8	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/2½	1d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£42	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 2/-	..
e " " medium	"	2/6 to 6/-	..
e " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/9½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Errors in Thermometry.—In a recent number of *La Nature*, the eminent French scientist, M. Le Chatelier, has an article on the measurement of high temperatures. He gives a brief description of the various methods at present in use, and devotes some space to a consideration of the thermo-electric (Le Chatelier) type of instrument. He mentions the necessity of the frequent regraduation of the thermocouples, which alter in use. Further, the sensitivity of the galvanometers used varies with time, either from loss of magnetism in the permanent magnets, or by changes in the verticality of the instrument. The moving coils, which are generally heavy, rarely have their centre of gravity exactly in line with the points of suspension. The result is a disturbing couple, which tends to modify the galvanometer readings. Very often errors are discovered, the exact cause of which it is difficult to trace. The most frequent trouble is that the wires of the couple come adrift when they are simply twisted together instead of soldered, or they break when heated in a reducing atmosphere. If contact ceases entirely, the trouble is easily discovered, but very often the wires continue to touch and allow the current to pass, but with a reduction in strength on account of the additional contact resistance, and the readings are therefore falsified without the observer being aware of the exact trouble. A cause of error, frequent in factories, arises through fine iron powder settling on the soft iron core, and damping the action of the moving coil slightly. This source of error is even more difficult of discovery than those mentioned above. Finally, in laboratory tests, when the couple wires are not immersed sufficiently in the substance to be tested, the thermal conductance of the wires cools the thermo-junction and affects the readings.

National Union of Manufacturers.—The articles of association of the National Union of Manufacturers, which were completed in June last, show that the Union is the successor of the British Manufacturers' Association, 1915. Mr. George Terrell, M.P., is chairman of the Union, which includes among its objects the promotion of the trade, commerce, and manufactures of British industries, and the home, colonial, and foreign trades of the United Kingdom.

The Union also desires to effect co-operation and mutual help among British manufacturers and producers of all kinds of goods and commodities, and to encourage free and unrestricted communication between masters and workmen with a view to the establishment of amicable arrangements and relations between them.—*The Times.*

DIRECT-CURRENT MACHINES: SOME NOTES ON ESTIMATING.

By "W. A. E. M."

When no actual recent cost is available of an exactly-identical machine, the estimating of a new size of generator or motor may entail a considerable expenditure of time, and often the costs that are at hand are not in sufficient detail

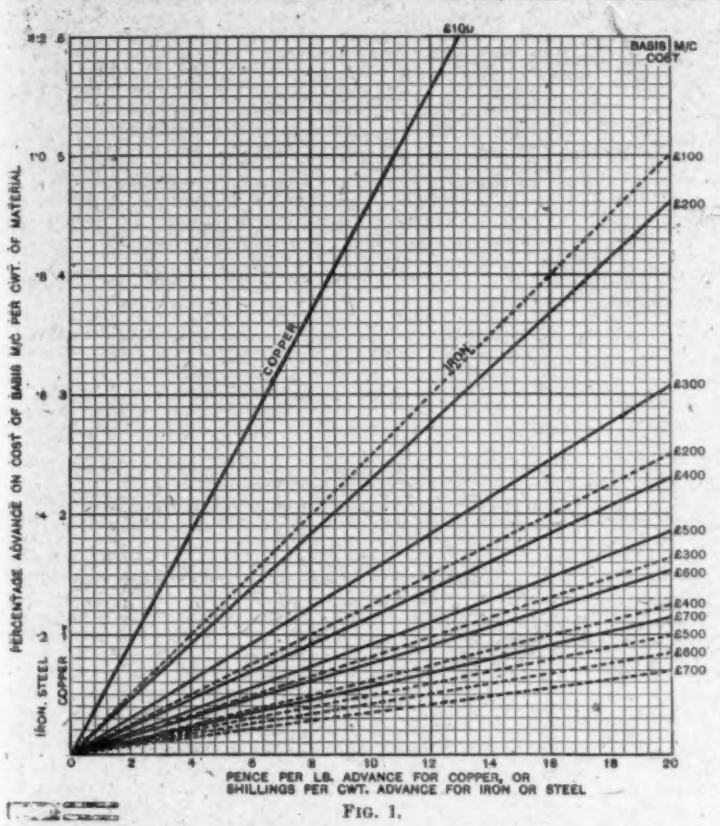


Fig. 1.

to lend themselves conveniently to manipulation, or admit of very close adjustments or *pro rátas* being made.

A handy *pro rata* rule is shown below for obtaining the approximate cost of a new machine, given the cost totals for labour and materials of the basis machine and dimensions of the armature core of the latter, and of the one to be estimated:—

Cost of labour $= \sqrt{D^3} \times k_l$,
Cost of material $= \sqrt{L \times D^3} \times k_m$,

where D = diameter of core (external) in inches, L = length of core (between end plates) in inches, and k_l and k_m = constants for (cost ÷ $\sqrt{D^3}$), and (cost ÷ $\sqrt{L \times D^2}$) for labour and material; these will vary according to the particular maker.

The writer has found that quite good results can be obtained in predetermining costs in this way, especially where the basis machine or machines taken for the values of k do not deviate very considerably from the new machines in the core dimensions; and, on occasions when it has been found convenient, or considered desirable, to use the more lengthy and closer methods, the application of the approximate rule shown has often proved a very useful check.

By the use of a further adjusting constant, which, from an intelligent analysis of machine costs, can be approximately deduced for correcting the price for increases in cost of labour or material, an up-to-date cost may be obtained. The value of the price-adjusting coefficient—let us call this k_a—providing for the advances in the markets will be found to be:—

$$1 + \cdot0001\,[x\,y + (100 - x)\,.\,z],$$

where x = per cent. labour cost of total cost, y = per cent. advance on labour, z = per cent. advance on material.

The adjoining graphs (fig. 1) show values of percentage advance on total cost per cwt. of material for the principal and heaviest items of material used in the machine, viz., copper and iron (or steel), according to the price advances per lb. and cwt. respectively.

The graphs (fig. 2) show values for k_a for various combinations of x, y, and z.

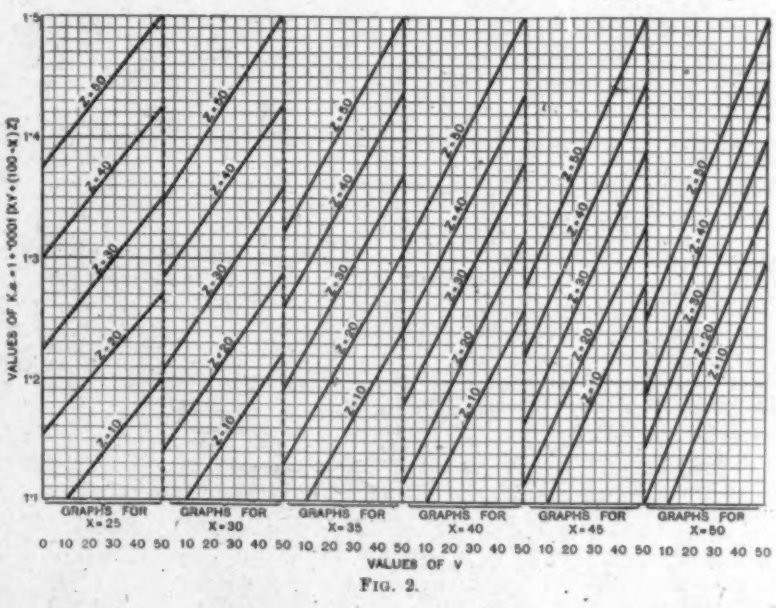

VALUES OF Ka = 1 + ·0001 [XY + (100 - X) Z]
GRAPHS FOR X = 25
GRAPHS FOR X = 30
GRAPHS FOR X = 35
GRAPHS FOR X = 40
GRAPHS FOR X = 45
GRAPHS FOR X = 50
VALUES OF Y

Fig. 2.

MULTIPLEXING IN CABLE TELEGRAPHY.

In the *Journal of the Franklin Institute* for May, Brigadier-General George O. Squier, Chief Signal Officer, U.S. Army, states that the use of alternating currents in cable telegraphy offers the great advantage that multiplexing is made possible. Among the many schemes which may be utilised, the method of using separate cables for sending and receiving, transmitting several messages on one cable and receiving a corresponding number on another, seems to offer the best solution of the problem where the volume of traffic warrants it. Such an arrangement eliminates the artificial cable, which is an indispensable element in duplexing, and at the same time gets rid of all the troubles incidental to the accurate balancing of the duplex bridge.

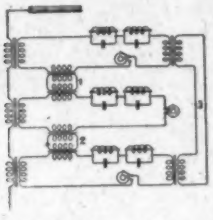
The method proposed is shown schematically in the two accompanying figures (p. 166). In fig. 1 an arrangement is shown for transmitting three messages simultaneously on one cable. We have here three local transmitting circuits coupled to the cable, the frequency of each transmitter being different from that of any other—say, 6, 8, and 10 cycles. In each local transmitting circuit, two looped circuits are included, which are separately tuned to the frequencies of the other two transmitters, offering thereby a high impedance to the current flow of these frequencies, and thus preventing the transfer of current from one transmitting circuit to the others

To further check any transfer of current from one local circuit to another, the intermediate circuits 1, 2, and 3 are introduced, through which E.M.F.'s of opposite phase to that induced by way of cable transformers are induced, thus balancing out any residual effect from one circuit on another.

In fig. 2 a receiving terminal of a cable is shown in which three circuits are used for the reception of three messages simul-

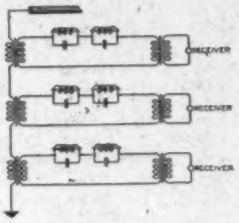
aneously. Each receiving circuit is coupled to the cable through an intermediate circuit. In each intermediate circuit, two loop circuits are included, which are separately tuned to the frequencies of the signals which are to be excluded from that particular receiver, each receiver responding accordingly only to a signal of one predetermined frequency and excluding the others. If desired, loop circuits may also be introduced in the receiver circuits, and thus further increase the selectivity.

In the arrangement described above, the disturbing effects of a local transmitter on the receiver, which are always present to a



Transmitting terminal.

FIG. 1.



Receiving terminal.

FIG. 2.

greater or less degree in duplexing, are entirely eliminated, and, as a consequence, detectors and amplifiers of very much greater sensitiveness may be employed.

For purposes of illustration, three transmitters and three receivers are shown, so that two cables could handle three messages both ways, but obviously the method outlined above is not limited to this number.

PERMANENT MAGNETS.*

By F. C. KELLEY.

By means of the hysteresis loop we are able to determine the two most important facts that we ought to know about steel for permanent magnets, namely, the remanent magnetism and coercive force: the height of the point where the curve cuts the vertical axis, and the breadth of the loop on either side of the zero point. The coercive force is the more important. Though the magnetic permeability of a specimen is inversely proportional to its carbon content, the amount of permanent magnetism retained is directly proportional to the carbon content.

The hard constituent called hardenite, which may be a solid solution of carbon in iron, or possibly a subcarbide of iron, is of the same percentage as pearlite, and is formed during any cooling that is so rapid that the particular pearlite structure has no time to form. This constituent appears to be the most important in magnets.

The shape and dimensions of a magnet have a great effect upon its retentivity, due to the fact that the poles of every magnet exercise a self-demagnetising influence on the body of the magnet.

The demagnetising effect in the case of slit rings has been shown to be nearly proportional to the width of the slit, or gap in the magnetic circuit. If the ring is provided with large pole pieces and the gap is narrow, the demagnetising coefficient may be greatly reduced. The amount of remanent magnetism increases regularly with the dimension ratio, that is, the ratio of the length to the diameter of the bars.

A laminated magnet has been found to be no more powerful than a solid magnet of equal weight and length.

Since the coercive force of magnets depends upon the way they are hardened, it is essential for magnets which are to have the greatest coercive force that they be quenched at a temperature above that at which they recalesce, and quenched quickly.

Magnetic material which has had previous working should be annealed slowly, and then quenched just a little above the point of recalescence. Mme. Curie tried experiments on the effect of quenching carbon steels of 0.06-1.20 per cent. C, and found that 770 deg. C. was the best temperature for quenching. If quenched at 975 deg. C. the remanence and coercive force both fell in value. She also found that the best magnet material, after hardening, if reheated to 905 deg., degenerated. By quenching first a little above and then a little below the point of recalescence, and going through this cycle several times, she found that the material could be improved, and that material which had become poor by over-heating could be repaired.

Barus and Strouhal found that annealing at a temperature which gave a blue tint produced the best results. They also found that for short bars a glass-hard state, produced by heating to a bright red, and quenching in cold water, gave the best results.

The tungsten steels which have proved best for magnets fall in two groups: (1) Those containing 5 to 7 or 8 per cent. W with about 0.5 per cent. C, and (2) those containing 2½ to 3½ per cent. W with 1 per cent. C. Steels containing from 0.75 to 9.5 per cent. of chromium have high coercive forces; but there seems to be little advantage in adding more than 2½ or 3 per cent. Cr. Cast iron makes good magnets. Campbell, by quenching at 1,000 deg., found values of remanence from 200 to 229, and coercive forces from 48.9 to 52.8.

The method of magnetising bar magnets is to put them inside a long magnetising coil about twice as long as themselves. Short bar magnets may be put between the poles of an electromagnet, as may horse-shoe magnets. The field to which they are subjected should not be less than H = 250. Little depends upon the duration of the operation.

Permanent magnets age with time, or lose part of their magnetism. Causes for the decay of magnetism of magnets are mechanical shock, changes of temperature, contact with magnets or iron, and exposure to demagnetising forces. The lapse of time also apparently effects a deterioration. But in all magnets there seems to be a limit to this decay.

Permanent magnets are matured by repeated gentle heating and cooling, protracted gentle heating, repeated subjection to mechanical shock, and partial demagnetisation.

Barus and Strouhal found that by heating a glass-hard magnet in steam for 60 hours, then remagnetising, and steaming again, its remanence was reduced to a constant value. After this treatment it was dropped from a height of 1.5 to 0.5 m. on a wooden block, and it did not change over 0.54 per cent.

Mme. Curie found that heating magnets in steam caused a reduction of both coercive force and remanence, and that reheating to 200 deg. C. was disastrous, for about 50 per cent. of the original total magnetism was lost.

W. Brown found that glass-hard magnets resisted shocks much better than others, and that by prolonged reheating at 60 deg. a constant state was reached with a reduction of from 1 to 3 per cent. in best steels.

Krüse found that materials having the greatest coercive force had the least percentage loss from shock.

To produce permanent magnets which are both constant and powerful, a tungsten steel should be used, having from 5 to 8 per cent. of tungsten and from 0.4 to 6 per cent. carbon. Chromium up to 2 or 2.5 per cent. may be present, but the presence of manganese, titanium, copper, sulphur, and phosphorus should be avoided. For bar magnets the dimension ratio should be as large as possible. For horse-shoe magnets the gap between the poles should be short as possible, and the polar areas as large as possible.

The forging of magnet material should be done with little working of the material, and at a low temperature. After forging it should be normalised by raising to 900 deg. C., lowered to 750 deg. for a time, and then cooled off. To harden the magnets, they should be heated to 950 deg. C. for five minutes only, then lowered to 700 deg. C., and quenched in brine or oil at 20 deg. C. Some tungsten steels are better if quenched between 770 and 850 deg. C.

There is no advantage in tempering tungsten steel. Magnets of carbon steel of 20 diameters may be tempered to a straw tint, and those of 40 diameters to a blue tint. Any letting down below a straw tint impairs their power to resist decay and usage.

Magnets should be matured by boiling or steaming for 10-12 hours, or by heating them to 60 deg. C. for 20 or more hours. There is some advantage in letting them cool several times during the process.

The magnet should be magnetised by an electromagnet, or, if a bar magnet, by a magnetising coil, using the highest degree of magnetisation possible. There is some advantage in reversing the magnetism a few times, but in the final magnetisation the current should be turned off slowly to zero. There is an advantage in giving the magnet a slight mechanical shock. Some magnets which are to have extreme constancy are subjected to demagnetising forces.

Cr, Mn, Mo, and W are important additions in the manufacture of steels for permanent magnets, but the presence of a third element is necessary. While carbon is beneficial, highly satisfactory results are to be obtained with Si and vanadium, especially vanadium.

The following table represents some of the best alloys obtained for permanent magnets. The first section shows results obtained before rapping or ageing; the second after rapping:—

Composition.	Before ageing. B (Ret)	Before ageing. H_c	After ageing. B (Ret)	After ageing. H_c
8 Mo, 0·3 V, 0·6 C	11,750	53·7 quenched	5,000	57·2 quenched
5 W, 0·5 C	11,700	59·0 ,,	5,200	52·5 ,,
5 Cr, 3 Mn, 4 Mo, 1 Si	11,350	55·8 as forged	5,300	64·7 as forged
1 Mn, 10 Mo, 0·5 C	10,750	58·4 quenched	5,400	57·5 quenched
2 Cr, 10 Mo, 0·5 C, 0·3 V	10,500	78·0 ,,	6,300	77·2 ,,
7 W, 0·3 V, 0·6 C	10,450	39·4 as forged	5,600	81·0 ,,
16 Mo, 0·3 V, 0·4 C	10,950	59·8 quenched	—	—
2 Mn, 5 Mo, 0·6 C	—	—	5,500	57·2 as forged
6 Cr, 0·84 Si	—	—	5,200	52·8 quenched
2 Cr, 16 W, 5 Mo, 0·3 V, 0·5 C	—	—	5,600	69·5 ,,
10 Mo, 1 V, 0·4 C	—	—	5,000	50·5 ,,

The general idea about permanent magnet material is that the harder it can be made the greater its permanence. Comparative tests on materials quenched in water or brine would be expected to show that the harder the piece, the less permeable, the lower its residual induction, and the higher its coercive force, but it is only true with certain steels under restricted conditions.

* *General Electric Review.* Abstract.

It is well known that the hardening capacity of steel decreases as its mass increases, yet the larger mass, and hence the softer piece, is magnetically most permanent.

It is well known, too, that the rate of cooling in oil is slower than in water, and does not give as great hardness. Yet experiments on steel, which was quenched both in water and in oil, show relatively soft oil-hardened pieces when compared with water-hardened pieces of the same size to have lower induction, lower residual and higher coercive force than the much harder water-quenched pieces.

Drawing the temper of steel has a very marked effect on the magnetic properties. Hardness may be relieved by drawing the temper, but this gives results directly contrary to those due to retarded quenching rates. That is, the maximum induction and residual magnetism are increased, and the coercive force is lowered. This is true whether the steel owes its original hardness to oil or water hardening, and it is also true that the effect of tempering is more marked on oil-hardened than on water-hardened pieces. That is, the augmented permanence in these alloy steels, due to oil hardening, is unstable, and this fact limits the possible commercial application of oil-hardening of magnets in manufacture.

Boiling in water has only a slight effect upon the magnetic tests, while drawing the temper at 205 deg. C. (400 deg. F.) seriously impairs the magnetic permanence. This is true of both the structural alloys and the commercial magnet alloys. At a drawing temperature of 315 deg. C. (600 deg. F.) the difference between oil and water-tempering is wholly wiped out, and nearly identical tests result.

REVIEWS.

Electrical Engineering Practice. Third Edition. By J. W. Meares, F.R.A.S., M.Inst.C.E., M.I.E.E. London: E. and F. N. Spon, Ltd. Price 25s. net.

The author, in his preface, states that in re-writing this book for the third edition he intends it to fill the gap between the engineering pocket-books, which give a mass of highly-condensed information, and the specialised works, each dealing with a particular subject in detail. A book of this kind is by no means easy to write, owing to the difficulty of maintaining a due sense of proportion, and of avoiding giving prominence to one particular subject at the expense of others. The author of the book under consideration, while he cannot altogether be said to have escaped this defect, has nevertheless carried out his intention with a large measure of success, and has produced a work which should be a very valuable one, particularly to engineers whose connection with electricity is only secondary. The author's style is exceedingly clear and lucid, and his meaning can always be grasped at a first reading. This circumstance largely atones for the lack of diagrams in many places, which goes far to impair the utility of the work.

The book is divided into three parts, dealing respectively with elementary principles, installation work and domestic applications of electricity, and electrical plant and supplies. The first part is concerned with fundamental principles and elementary facts relating to the supply and applications of electricity, and suffers somewhat from a lack of logical sequence in the arrangement, and also from a lack of diagrams to explain the text. The author makes use of the hydraulic analogy to explain the relationship of electrical magnitudes, and his treatment is clear and convincing, but the corresponding treatment of the more complex magnetic units is poor. A lengthy description of the potentiometer could have been condensed to one quarter the present length if a diagram had been added. All the information given is, however, quite accurate and precise; as an example, in the section on instruments, the difference between "aperiodic" and "dead beat" is explained.

The second part of the book, dealing with wiring and the domestic applications of electricity, is a very good one, and contains a mass of valuable information. Modern interior lighting systems are fully treated, and the information regarding domestic heating apparatus is excellent, although the chapter would have been greatly improved by a more liberal use of illustrations. Installation work is dealt with fully, modern wiring systems and up-to-date methods of switching being described. The author would have done well to have pointed out the waste involved in indiscriminate "looping in," and to have indicated how this can be avoided by the use of modern accessories.

The third part deals with all remaining subjects covered by the title of the book, with varying degrees of thoroughness. The chapter referring to motors, welding plants, and electric furnaces is a good one, although the diagram of a motor starter on page 260 can hardly be said to represent modern practice. A chapter on smaller generating plant and accumulators follow. An interesting, but lengthy, account of systems of charging and tariffs divides this chapter from the remarks on larger plant for public supply. References are given for descriptions of automatic voltage regulators; a brief account of the most important of these would have been valuable. The few lines devoted to the motor converter seem quite inadequate, considering the importance of this machine. The author has discussed modern tendencies in power-station development at some length, referring, for example, to the recent proposals and experiments in connection with the gasification of coal before burning under boilers, and the recovery of by-products. There is no reference in this chapter to the remarkable efficiency of the Ljungström turbine in the smaller sizes; and the subject of E.H.T. switchgear can hardly be said to have been touched upon. Excellent chapters follow on the application of water power, electric traction, electric vehicles, and electricity in mines. Transmission schemes are next dealt with, together with the subject of underground cables. The treatment of the latter subject shows the lack of balance that has been before referred to. While three pages are devoted to an excellent section dealing with up-to-date practice in the manufacture of cables for very high voltages, giving a clear explanation regarding graded insulation and intersheaths, the wider subject of cable-laying systems is dismissed in two pages. A good chapter on specifications and depreciation follows, and the final chapter is devoted to the subject of testing. In many ways this is the least satisfactory in the whole volume. The treatment is generally scanty, while the reference to the induction method of fault localising is so superficial as to be misleading. The same can be said of the paragraph on meter testing, in which one-quarter load is given as the lowest load to which meters should be tested. If this final chapter had received fuller treatment, even at the expense of some of the earlier chapters of more limited interest, it is safe to say that the work would have been considerably improved.

The book contains over 100 tables, and a useful list of these is given at the beginning. Extracts from wiring rules and standard specifications are given in the sections dealing with various aspects of installation and other work. These rules and specifications might well have been reprinted in full as an appendix. The value of the book is considerably enhanced by numerous cross-references and by the provision of an excellent index. The book can be recommended as a valuable work of reference, covering a wide field, and containing an immense amount of useful and up-to-date information.—G. W. S.

The Range of Electric Searchlight Projectors. By Jean Rey. London: Constable & Co., Ltd. Price 12s. 6d. net. (Translated by J. H. Johnson.)

Searchlights play so important a part in the work of our land, sea, and air forces that the appearance of this book is particularly opportune, especially as no treatise has hitherto been available making it possible for artillery officers to calculate the range of searchlights with some approximation to the ease and accuracy with which they calculate the range of their guns or—more generally—making it possible for any user of a searchlight to determine the distance at which the latter will illuminate effectively a stated objective. The problem is not altogether simple, and its solution involves many indeterminate variables (especially those dependent on atmospheric conditions); nevertheless, the author's work represents a material advance in range measurement from the practical point of view.

The study of the range of electric searchlights comprises the determination of luminous flux emitted by the arc; the extent of distribution of this flux as received and reflected by the mirror; the calculation of the amount of light projected at a distance, allowing for the size of apparatus and focal length of mirror. Knowing the amount of light projected at a distance by the searchlight, it is possible to calculate approximately the range of illumination by taking into account the coefficient of atmospheric absorption. It then becomes possible to determine for any given searchlight the probability of being able to illuminate a certain object at a given distance, provided that one knows the average degree of atmospheric transparency for the district.

The author handles the subject along these lines, dealing first, in Chapter I, with determination of the luminous flux emitted by any arc, pointing out the distinction between theoretical and practical results, and giving a number of useful formulæ and data. The theoretical illumination obtained with a specified reflector is next considered. A series of reflectors ranging in diameter from 0.3 to 2 metres is assumed, and the luminous flux corresponding to three different focal lengths is determined in each case, (*a*) for a series of low voltage arcs, (*b*) for a series of high voltage arcs. High voltage increases the luminous flux received by a given reflector, but necessitates the use of special carbons, difficult to obtain. In this chapter, again (as, indeed, throughout the book), the author shows clearly the corrections to be applied to theory in order to allow for the conditions of practice, and presents many useful formulæ and experimental data.

The efficiency of an electric searchlight (Chapter III) may be defined as the ratio of luminous flux projected at a distance by the apparatus to the flux emitted by the arc and received by the reflector. The author considers quantitatively each source of loss. A mirror in good condition should reflect 85 per cent. of the light falling upon it. In addition, there are shadow and shutter losses. The total efficiency in small and large searchlights respectively may be 65¼ per cent. and 73¼ per cent. without flashing shutters, or 51¼ per cent. and 67¼ per cent. with shutters.

Chapter IV gives data and curves for calculating the practical illumination from searchlights at a standard distance of 1,000 metres, knowing the theoretical illumination and the total efficiency of the searchlight. There seem to be a few misprints on page 44. The influence of current, voltage, and diameter of positive carbon on practical illumination is discussed, and it is shown that high-voltage, heavy-current searchlights have certain intrinsic advantages.

Although, for practical reasons, Mangin reflectors are used to a less extent than formerly, they have important optical advantages, and the author is justified in devoting Chapter V to consideration of the special results obtained with Mangin searchlights.

Having considered all the internal elements which affect the range of a searchlight (viz., power of the arc, diameter of reflector and focal length, efficiency of reflectors and searchlight), the author deals in the second part of the book with the external factors affecting range, viz., transparency of atmosphere, distance at which objective is placed, dimensions and nature of the objective, its colour and the colour of the background; finally, the distance at which the observer is from the searchlight and objective. The effect of transparency acts on the *double* range between searchlight, objective, and observer. This fact, the influence of form and colour of objective, and the limitations of visual acuity have all an important bearing on the fact that an airman (or working party, &c.) within an enemy beam may be so strongly illuminated as to feel certain that he is discovered whereas he may be absolutely invisible to the enemy observer. Striking instances of this sort are mentioned by the author, and it seems highly important that everyone in our forces should realise that he is not necessarily visible to the enemy although he is under comparatively brilliant illumination (*e.g.*, one and a half times that provided by the full moon at its zenith).

In Chapters VI *et seq.* the author starts from a formula of M. Blondel's for the range of searchlights (apart from visual sharpness). To facilitate the practical application of this formula the conception of "equivalent illumination" is introduced, *i.e.*, the illumination of various objects, under various test conditions, which renders them just visible (or clearly visible, as the case may be) assuming that the coefficient of reflection, diffusion, and physiological effect of contrast is the same for all objects. In other words, instead of attempting the very difficult operation of measuring this coefficient for each class of object, the author eliminates it entirely, and replaces it by empirical "equivalent illuminations." The latter are fictitious values, since they imply that the limit of visibility of the human eye for different illuminated objects corresponds to different quantities of light falling upon the retina. Once the table of equivalent illuminations is determined (and the author gives values for a whole series of land and sea objects), it is possible to calculate for the same objects the ranges under the conditions met in practice. Graphic diagrams are given to facilitate application of the general formula.

The question of atmospheric transparency is discussed at length, and typical data are given. The genesis and use of the graphic diagrams are well explained, and the curve sheets, abacs, and so forth are drawn clearly to large scale on folding plates. The examples and practical problems of ranges given in Chapter VIII should make the reader thoroughly competent to deal with any problem of his own. Throughout the book, data and curves relate to modern methods, appliances and constructions of war, and to climatic conditions in all the principal war zones of Europe on land and sea. Chapters IX and X deal with variation in ranges according to the size of searchlight and atmospheric transparency, and with visual acuity. The book presents in compact form a clear working exposition of the best methods and data at present available for determining the range of searchlights, and does not fail to point out where further data should be accumulated as opportunity arises.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

10,944. "Electric battery lamps." J. A. Ward. July 30th.

10,962. "Electrical switches." E. L. Rankin. July 30th.

11,031. "Electric motor control systems." British Thomson-Houston Co. (General Electric Co., U.S.A.). July 31st.

11,034. "Power-operated switches." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). July 31st.

11,035, 11,036. "Electric circuit controllers." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). July 31st.

11,038. "Circuit breakers." C. Longhi. July 31st.

11,060. "Process for manufacture of electrolytic compounds." J. Brown and E. Schreitlin. August 1st.

11,064. "Electrode clamp connector." A. Oates. August 1st.

11,065. "Telegraph systems." Automatic Telephone Manufacturing Co. and H. H. Harrison. August 1st.

11,071. "Magnetic compass." W. Thompson. August 1st.

11,073. "Electric detonators." W. J. E. Binnie & O. D. Lucas. August 1st.

11,078. "Sparking plugs for internal-combustion engines." B. Hopps and The Lodge Sparking Plug Co. August 1st.

11,079. "Secondary electric batteries or accumulators." Chloride Electrical Storage Co. & H. Dean. August 1st.

11,081. "Electric batteries." G. N. Antonoff. August 1st.

11,112. "Electric induction apparatus and submarine detectors." H. V. Cuthbert-Kerson. August 2nd.

11,149. "Starting devices for electric motors." W. P. Hamlyn, J. Sugden and The British Thomson-Houston Co. August 2nd.

11,154. "Electric batteries." G. N. Antonoff. August 2nd.

11,160. "Means for utilisation of light of electric lamps." G. Campbell. August 2nd.

11,217. "Electric arc lamps with rotary arcs, and wireless telephony and telegraphy." A. Garbarini, G. Gautier & L. Mauclaire. August 3rd.

11,222. "Dynamo-electric machines." N. Pensabene and Crompton & Co. August 3rd.

11,225. "Generating power." Westinghouse Machine Co. August 3rd. (U.S.A., August 11th, 1916.)

11,226. "Motor control systems." British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.). August 3rd.

11,230. "Machines for trimming ends of flexible and other insulated wires." Enfield Cable Manufacturing Co. & D. Wise. August 3rd.

11,231. "Electric batteries." G. N. Antonoff. August 3rd.

11,235, 11,236. "Ignition dynamos." C. T. Mason. August 3rd. (U.S.A., September 15th, 1916.)

11,249. "Make-and-break devices." F. B. Dehn (Pittsfield Spark Coil Co.) August 3rd.

11,287. "Electrical couplings or connections." K. E. L. Guinness. August 4th.

11,289. "Self-regulating dynamos." A. H. Midgley and C. A. Vandervell & Co. August 4th.

11,298. "Means for supporting electrodes in ionic tubes." F. P. Driver and Osram-Robertson Lamp Works. August 4th.

PUBLISHED SPECIFICATIONS.

1914.

16,203. Tubular Electric Incandescent Lamp Floats or Footlights. Chalier. July 15th, 1913.

1916.

The numbers in parentheses are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

3,029. Electric Battery Lamp. J. E. Hamilton. July 25th, 1916. (107,773.)

5,445. Electric Current Regulators, more particularly for use with Arc Lamps. E. C. R. Marks (H. Goldberg). April 13th, 1916. (107,777.)

6,965. Method of and Apparatus for the Localisation of Foreign Objects in and the Radiotherapic Treatment of the Human Body by the X-ray. C. Baese. May 17th, 1915. (100,491.)

7,995. Telegraphy. E. S. Heurtley. June 6th, 1916. (Cognate application, 11,465/16.) (107,783.)

8,320. Electrical Regulators or Rheostats. Switchgear & Cowans, and D. Rodway. June 13th, 1916. (107,786.)

9,568. Device for Locating, Capturing, and Destroying Submarines and like Vessels. S. Rushfirth. July 7th, 1916. (107,792.)

9,660. Lightning Conductors. G. E. Taylor. July 1st, 1916. (107,790.)

9,673. Revolution-direction Indicators and Counters. T. Kelly. July 10th, 1916. (107,802.)

9,833. Electric Oscillating or Wireless Systems and Apparatus. Indo-European Telegraph Co., A. H. Morse & H. R. Rivers-Moore. July 12th, 1916. (107,815.)

9,942. Electrical Resistance Apparatus. P. H. Dawe. July 14th, 1916. (107,822.)

9,949. Engine-room Telegraphs. J. W. Ray. July 15th, 1916. (107,823.)

10,036. Electrically-driven Vibratory Apparatus and the like, especially for use in the Treatment of Ear Troubles. Sterling Telephone & Electric Co. and F. G. Bell. July 17th, 1916. (107,825.)

10,386. Electrical Connectors or Junction Pieces. G. H. Collins & H. F. Collins. July 24th, 1916. (107,831.)

10,588. Attachment of Ammeters and Voltmeters to Supports, particularly in connection with Motor-driven Vehicles. Walsall Electric Co. and V. Delebecque. July 27th, 1916. (107,835.)

10,589. Ammeters and Voltmeters. Walsall Electric Co. & V. Delebecque. July 27th, 1916. (107,836.)

10,875. Ammeters for the Measurement of Alternating Currents and Electric Oscillations. August 2nd, 1916. (Cognate application, 11,337/16.) (107,844.)

11,812. Electric Lifting Magnets. A. West and A. West & Co. August 19th, 1916. (107,856.)

12,269. Sound Transmitting Instruments. T. Chalmers. August 30th, 1916. (107,864.)

13,097. Sparking Plugs for Internal-combustion Engines. T. Crosbee and Sons & H. W. Wilks. September 15th, 1916. (Cognate application, 13,859/16.) (107,873.)

14,246. Ignition Apparatus for Internal-combustion Engines. K. E. L. Guinness. October 6th, 1916. (107,888.)

18,145. Terminals for Electric Wires. Burney & Blackburne, and E. M. Cobb. December 18th, 1916. (107,924.)

1917.

5,529. Telegraphy. E. S. Heurtley. (Divided application on 7,995/16. Cognate application, No. 5,533/17.) June 6th, 1916. (107,950.)

7,093. Automatic Selectors for Telephone Systems. Siemens & Halske Akt. Ges. May 4th, 1916. (Addition to 23,336/13.) (106,506.)

8,553. Electric Oscillating or Wireless Systems and Apparatus. Indo-European Telegraph Co., A. H. Morse & H. R. Rivers-Moore. July 12th, 1916. (Divided application on 9,833/16.) (107,958.)

The Orbit of Mercury.—Speaking at the summer meeting at the Hampstead Garden Suburb, last week, Sir Oliver Lodge said he had been working on the variations in the orbit of the planet Mercury. This orbit revolved slowly, and there was a discrepancy known to all the great astronomers. Le Verrier found that it amounted to 43 seconds. It had remained a puzzle, and some had believed that it was due to the proximity of another planet, which could not be seen by us, and which had been named Vulcan.

Sir Oliver Lodge said he believed the discrepancy was explained by the electrical theory of matter. The inertia of a body moving at a high speed was greater than if were at a standstill. Mercury, the fastest planet in the solar system, travelled 30 miles a second. One lb. of matter moving at 30 miles a second, the speed of Mercury, equalled one lb. plus the hundred-millionth part of a lb., and that fraction was not subject to gravity. This was, he thought, the probable cause of the variation of the orbit of Mercury.